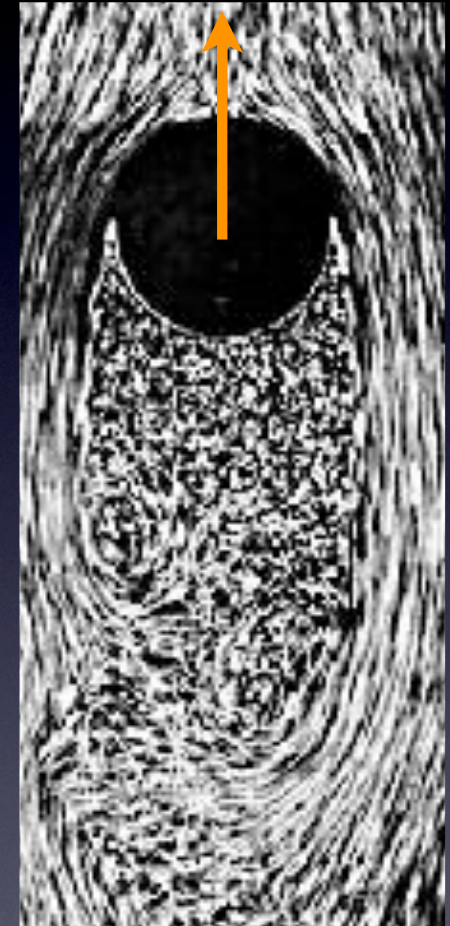
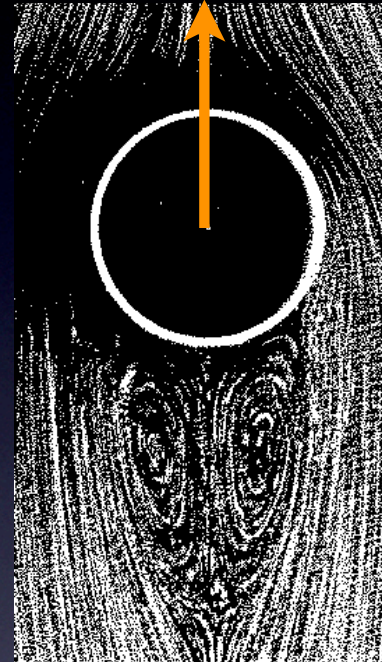
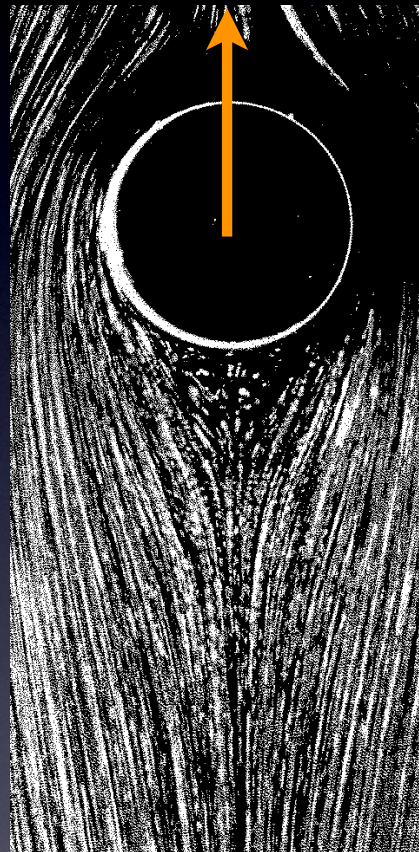
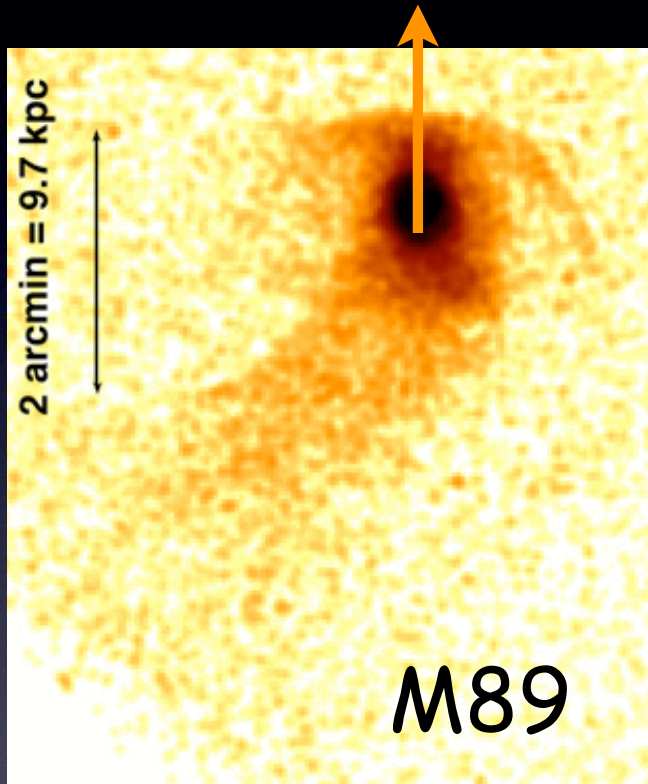


Viscous flow experiments with elliptical cluster galaxies

Kraft et al., Roediger et al., in prep.

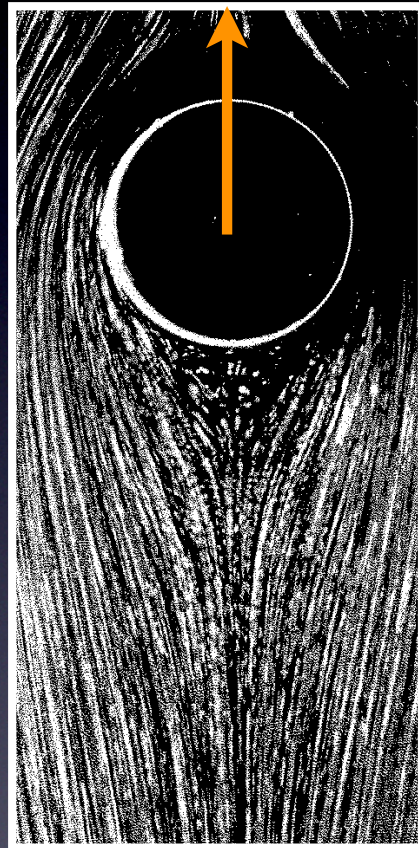


van Dyke - Album of Fluid Motion

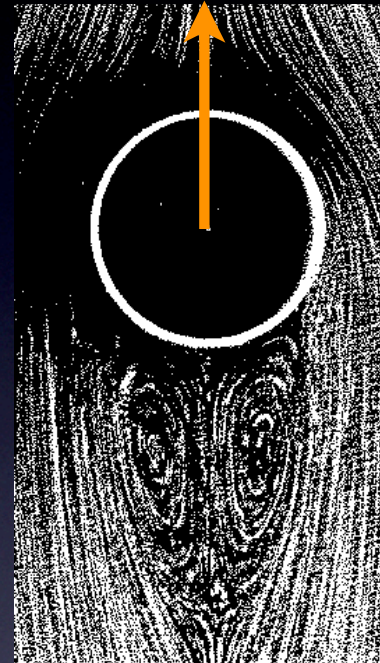
Elke Roediger (Hamburger Sternwarte), Ralph Kraft, Bill Forman, Paul Nulsen, Marie Machacek, Scott Randall, Christine Jones (CfA), Eugene Churazov (MPA)

high
viscosity

$Re=1.5$

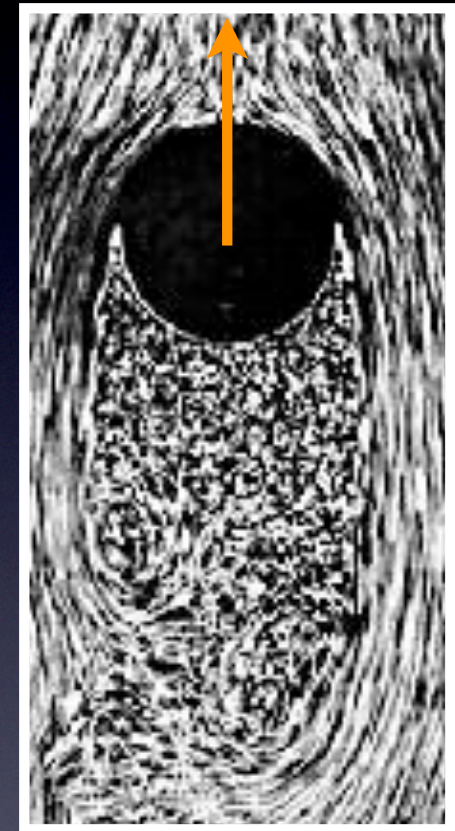


$Re=26$

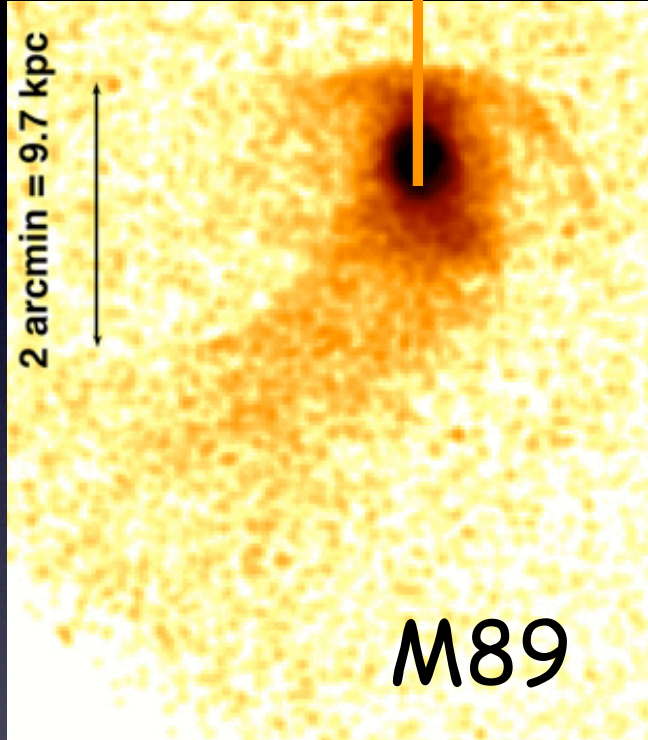


low
viscosity

$Re=2000$

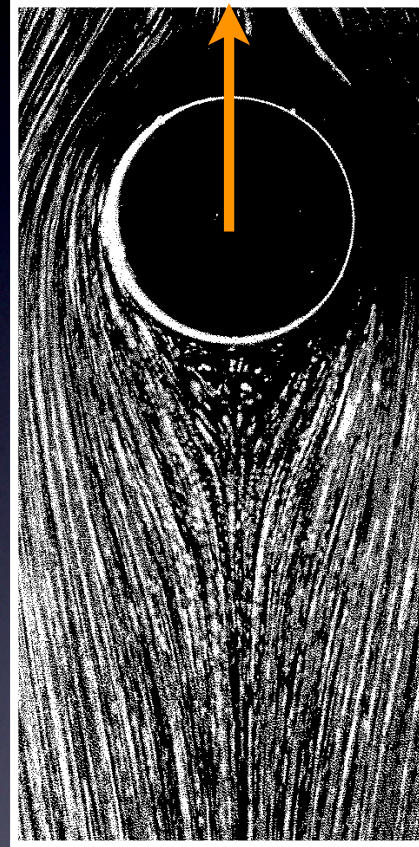


Kraft et al., Roediger et al., in prep.

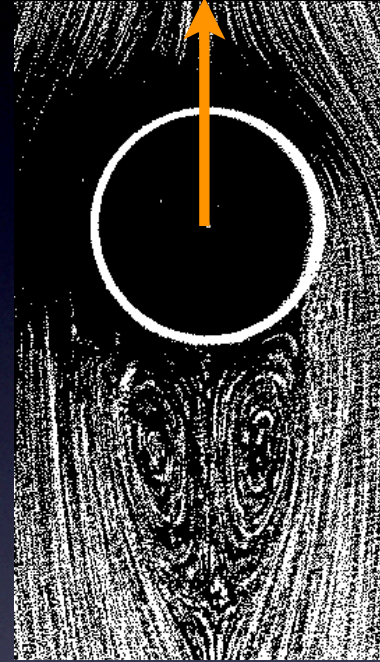


high
viscosity

$Re=1.5$

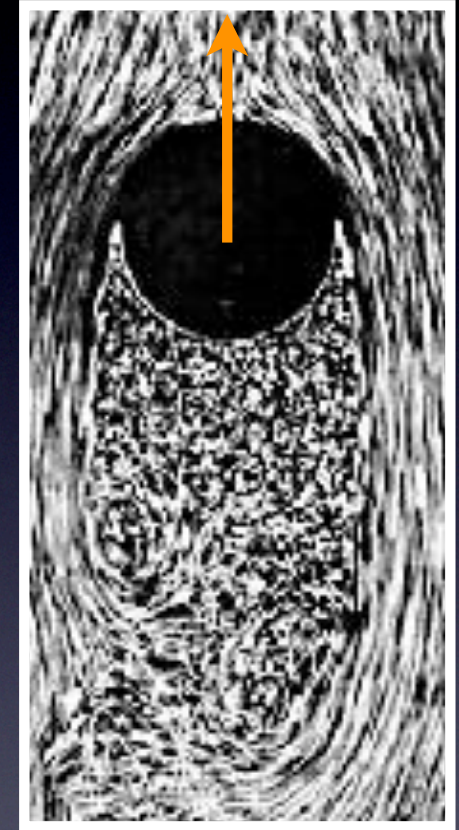


$Re=26$



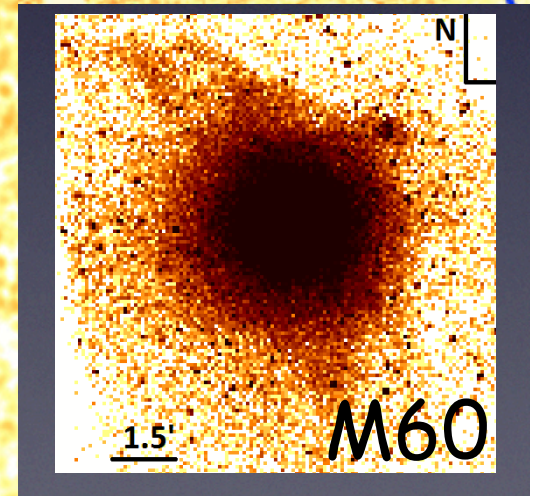
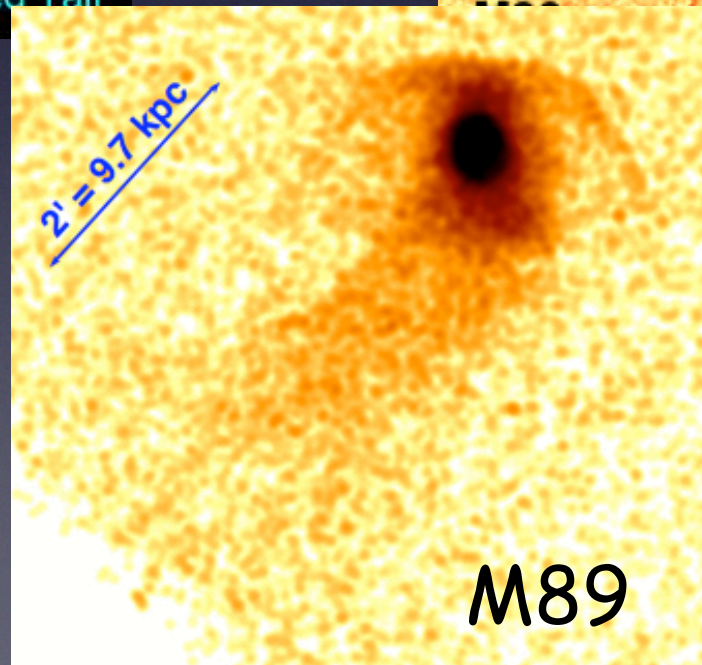
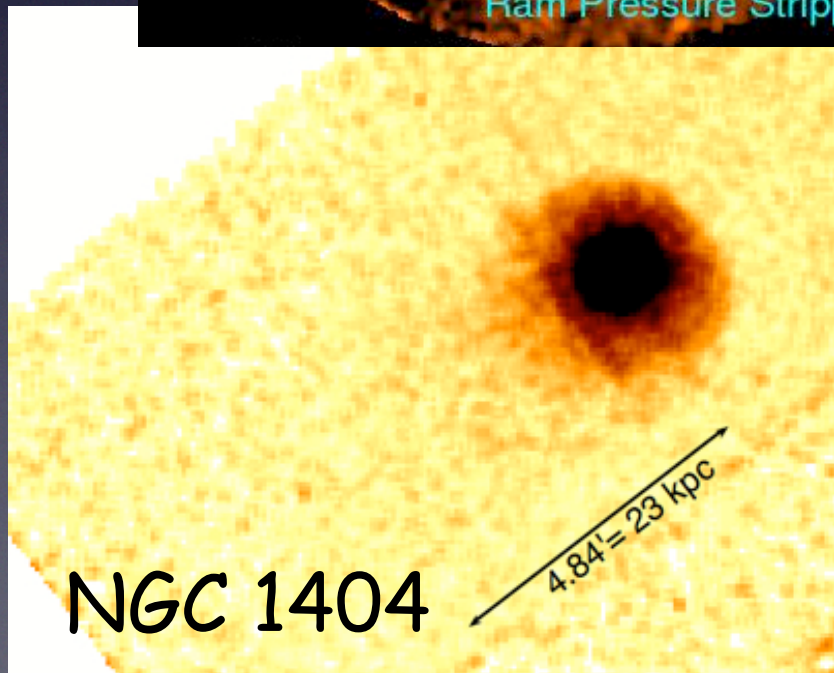
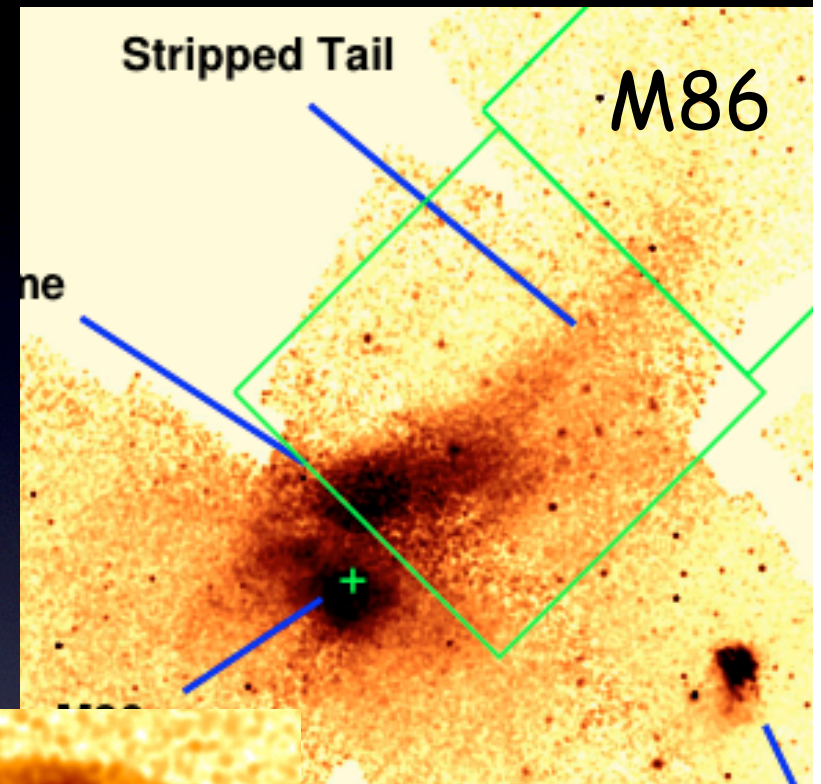
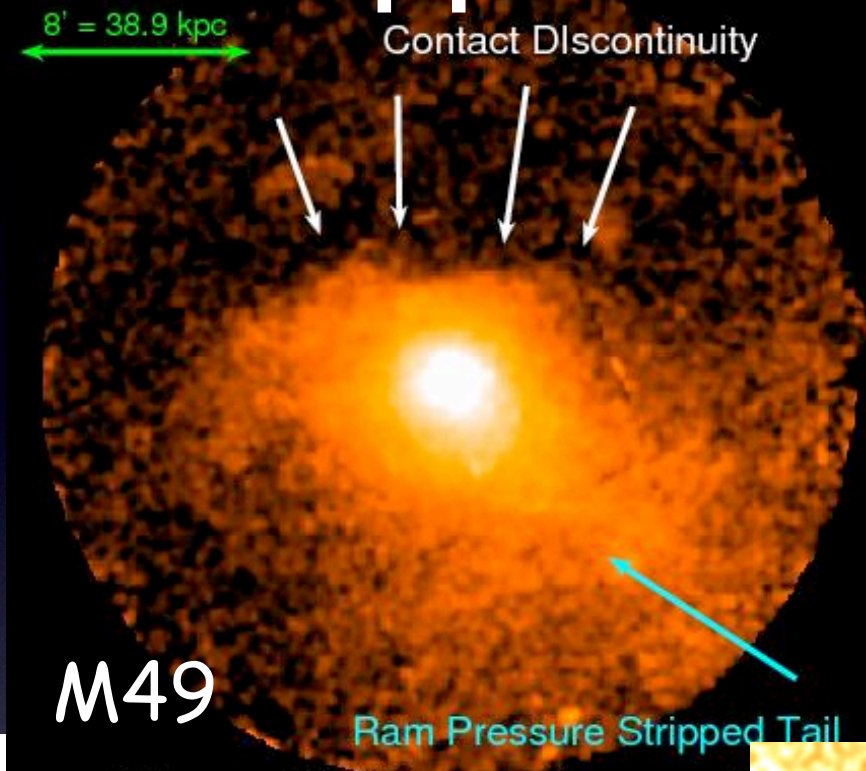
low
viscosity

$Re=2000$



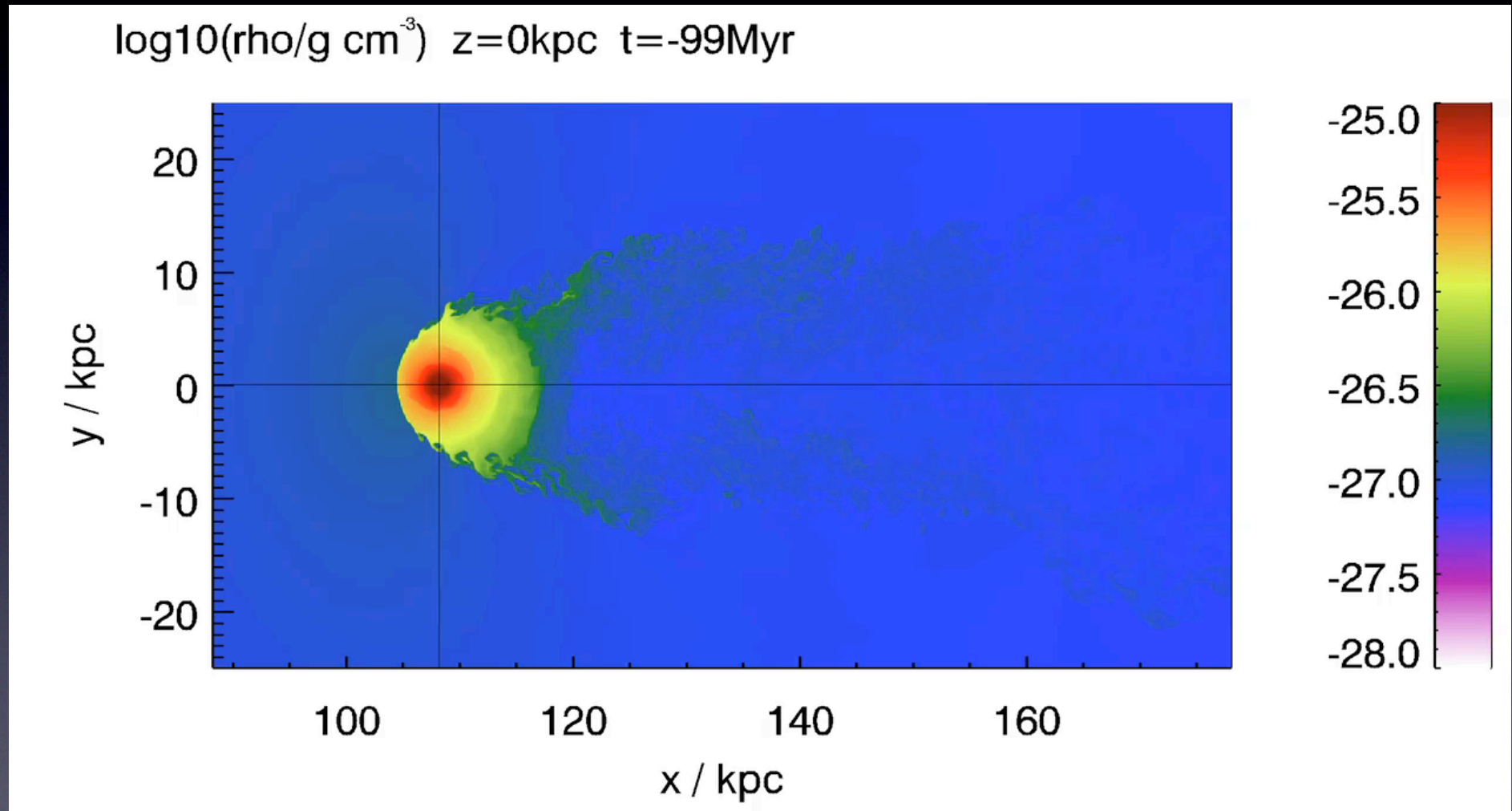
van Dyke - Album of Fluid Motion

Gas-stripped elliptical galaxies



inviscid galaxy stripping

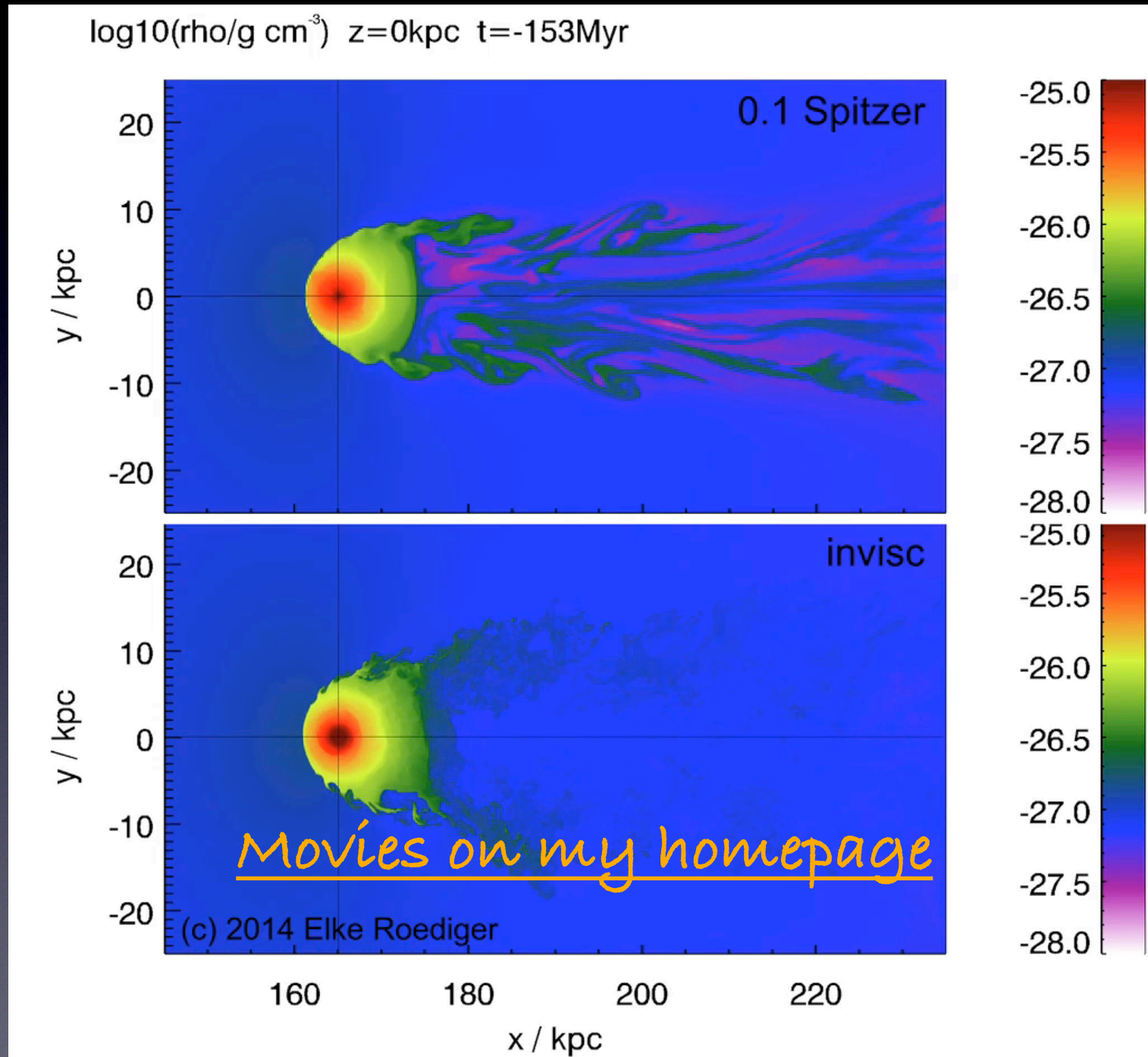
density slices



[Movies on my homepage](#)

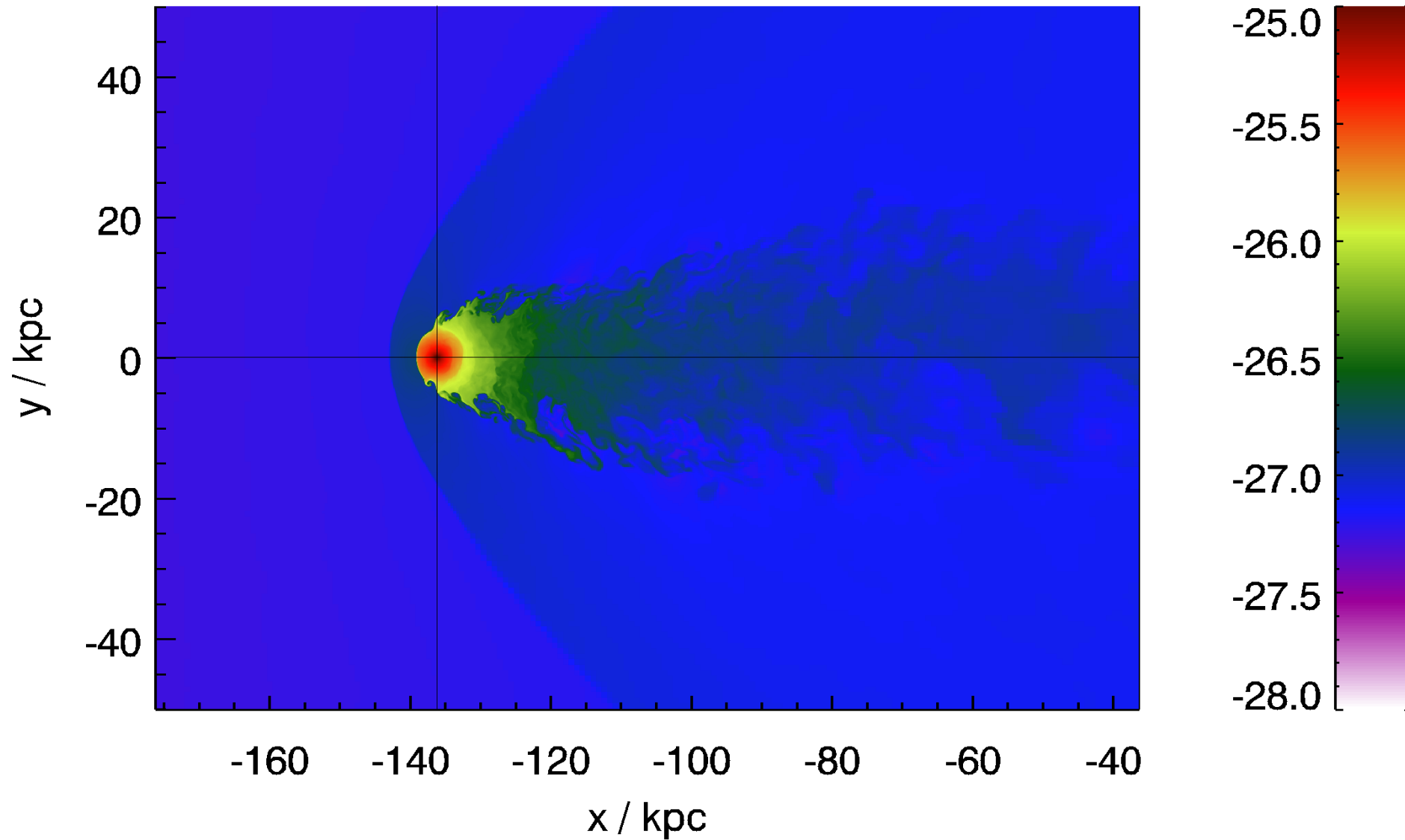
inviscid and viscous galaxy stripping

density slices



stripping of an extended atmosphere

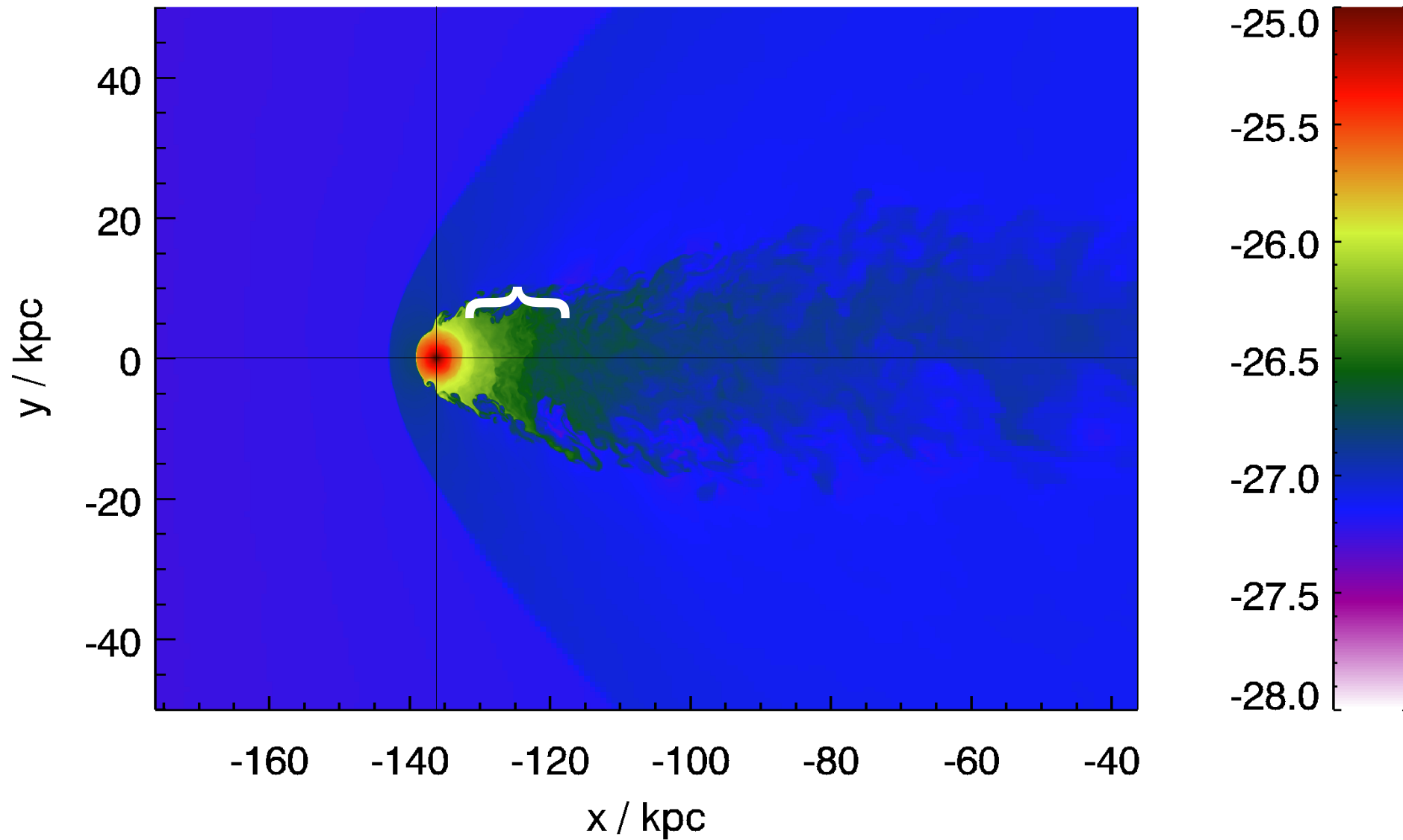
$\log_{10}(\rho/\text{g cm}^{-3})$ $z=0\text{kpc}$ $t=100\text{Myr}$



density slices

stripping of an extended atmosphere

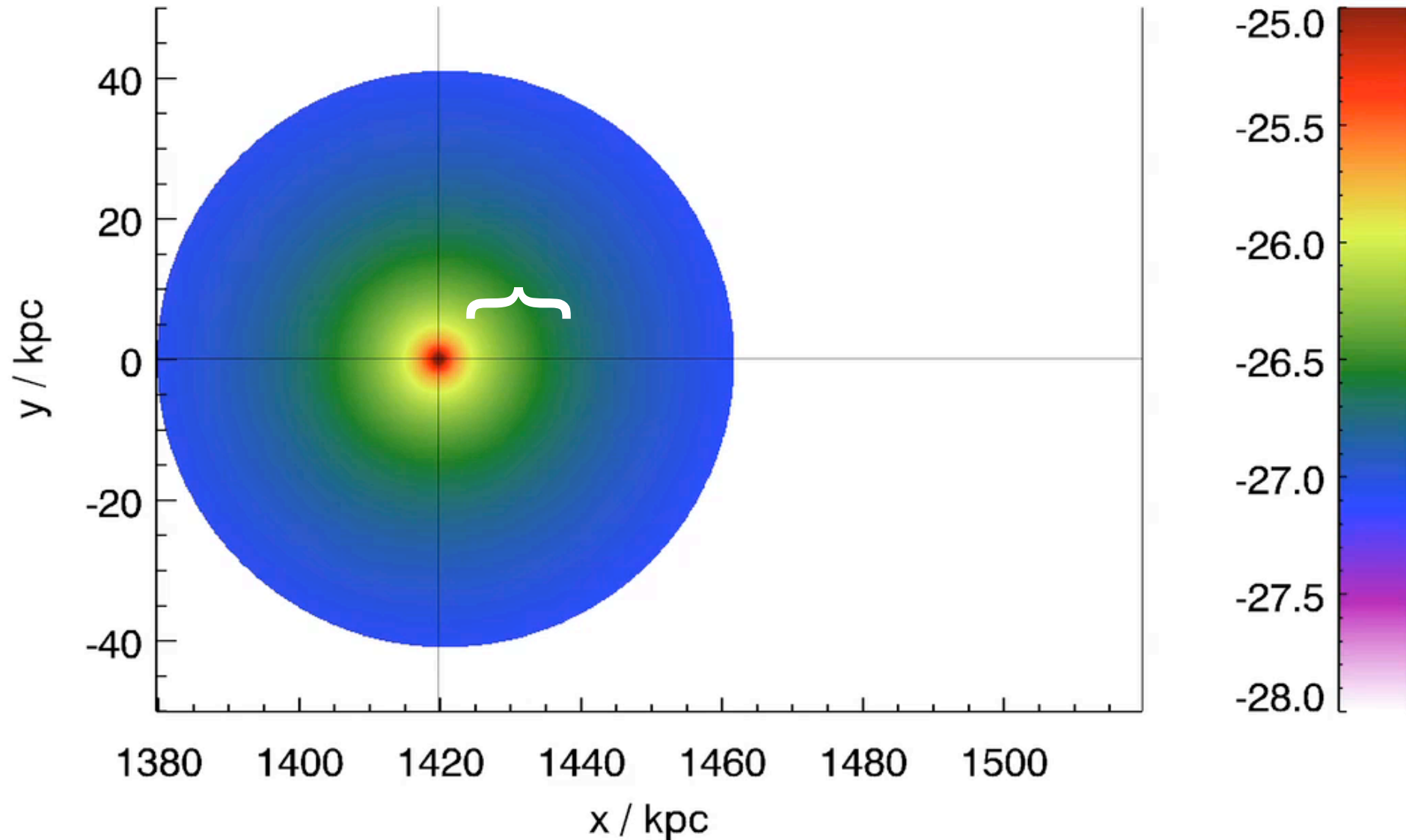
$\log_{10}(\rho/\text{g cm}^{-3})$ $z=0\text{kpc}$ $t=100\text{Myr}$



density slices

stripping of an extended atmosphere

$\log_{10}(\rho/\text{g cm}^{-3})$ $z=0\text{kpc}$ $t=-1500\text{Myr}$

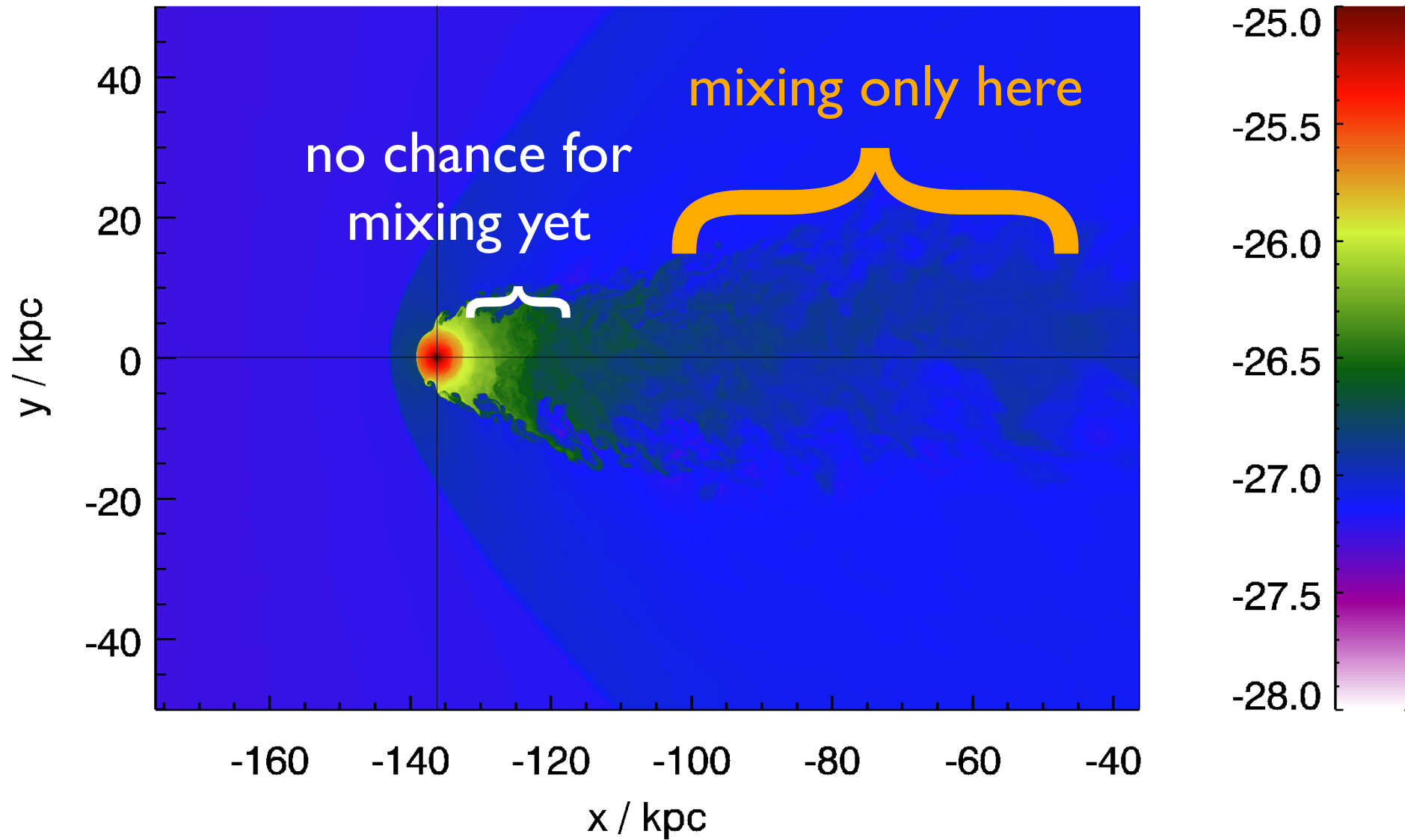


density slices

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stripping of an extended atmosphere

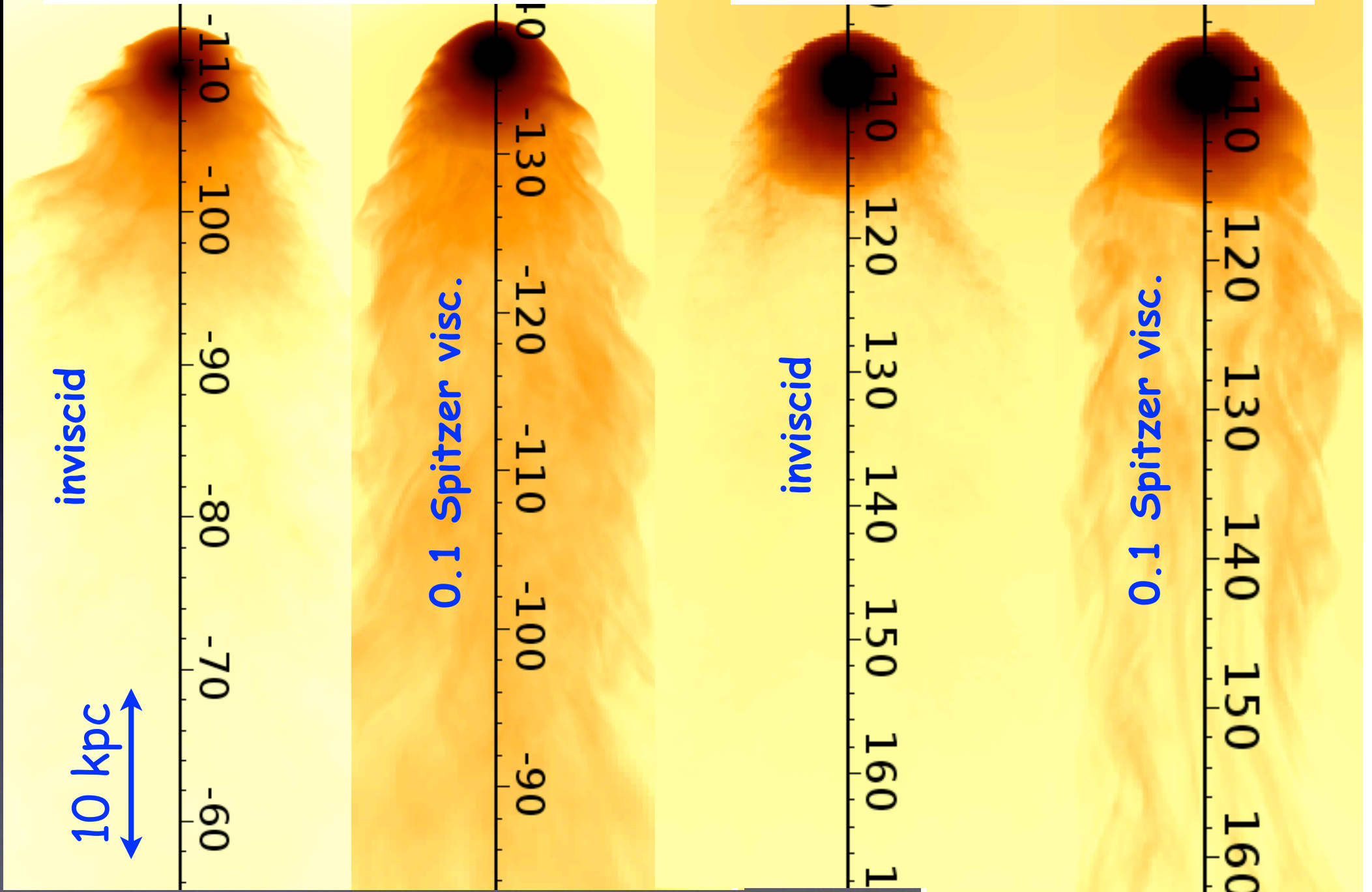
$\log_{10}(\rho/\text{g cm}^{-3})$ $z=0\text{kpc}$ $t=100\text{Myr}$



density slices

extended atmosphere

compact atmosphere



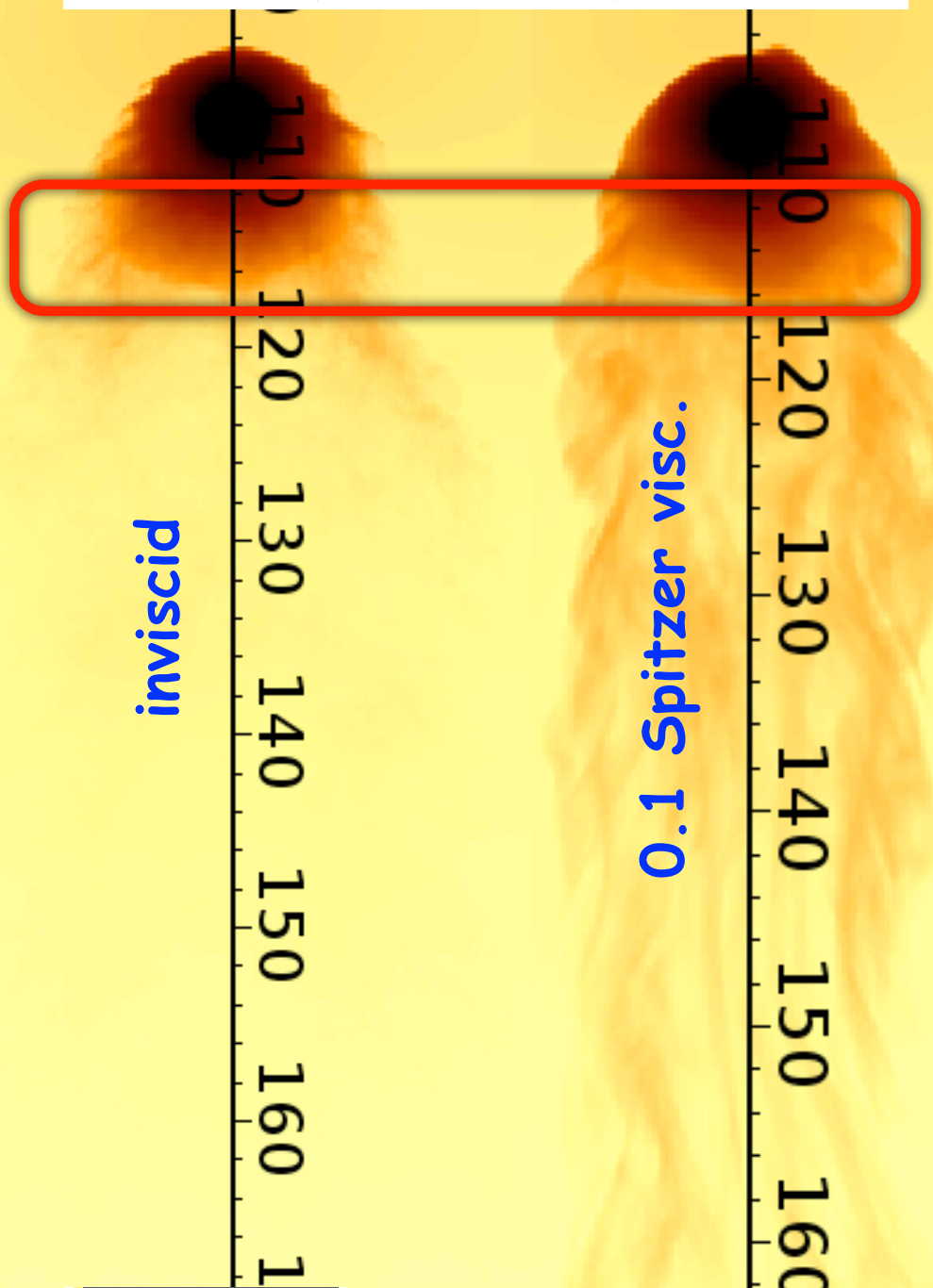
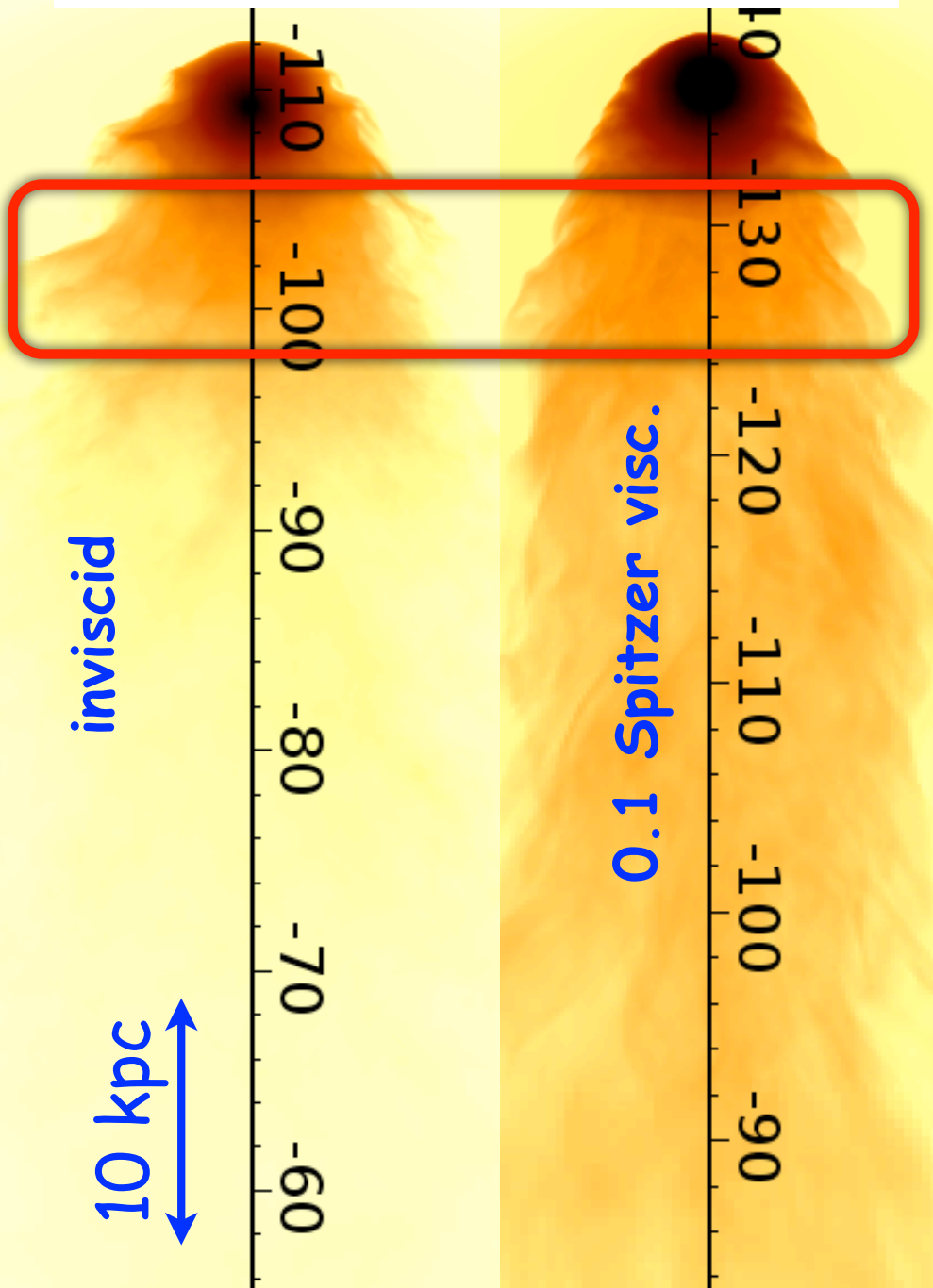
Mock X-ray (0.7-1.1keV)

Elke Roediger



extended atmosphere

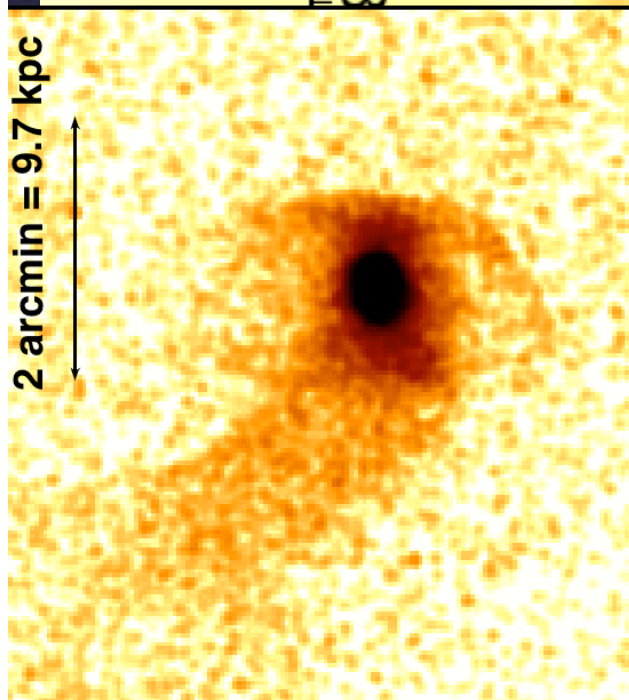
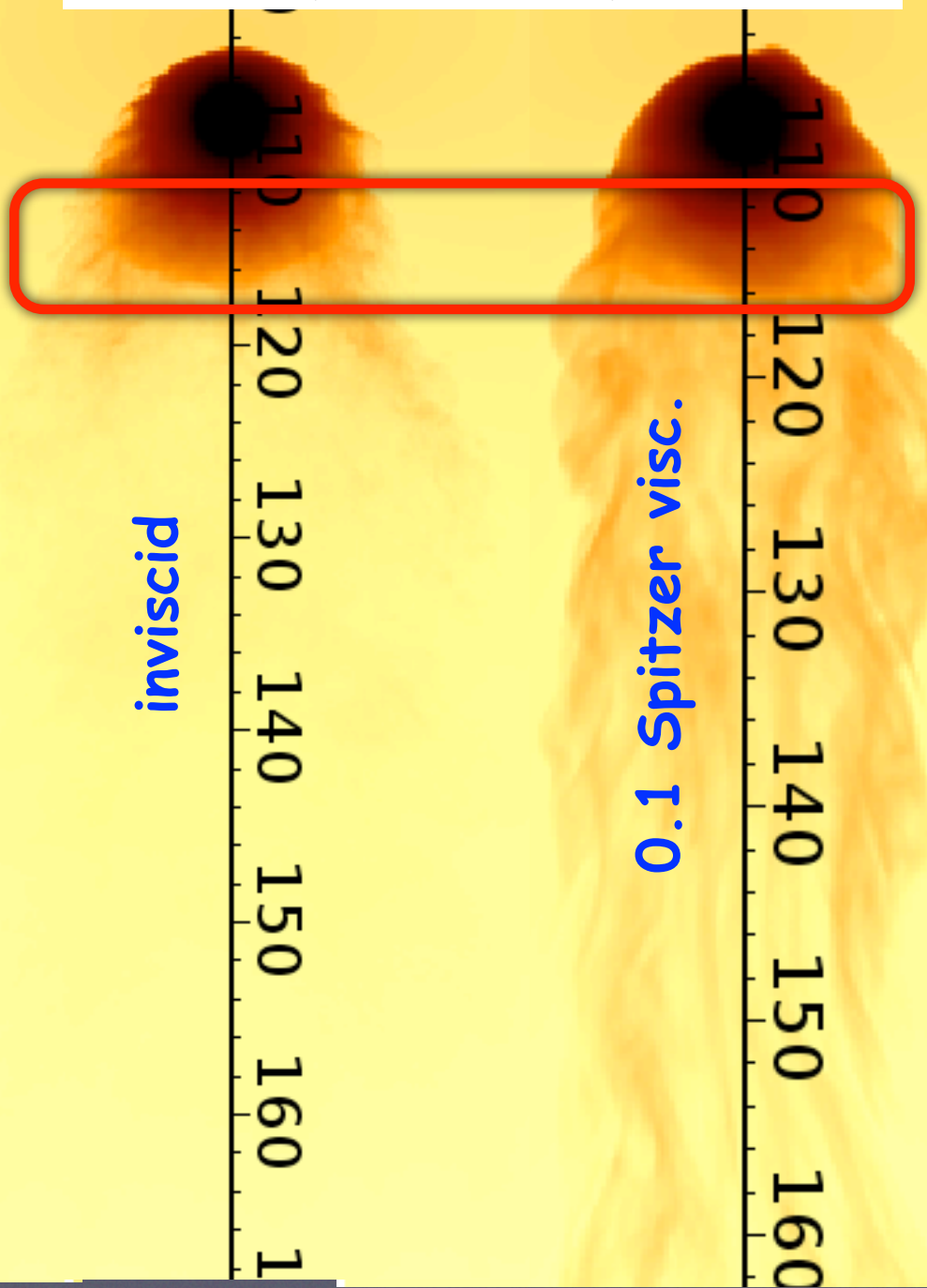
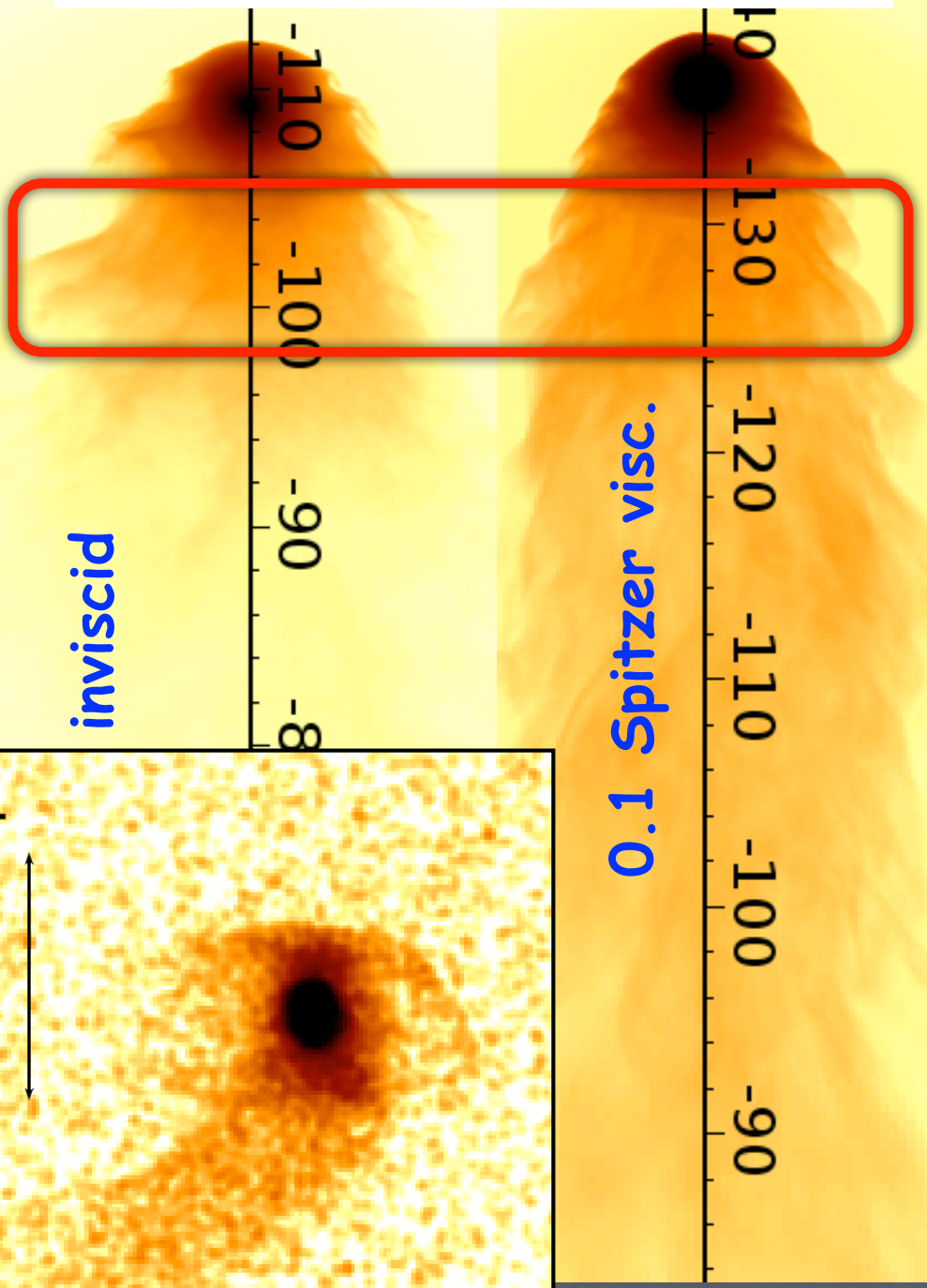
compact atmosphere



Mock X-ray (0.7-1.1keV)

extended atmosphere

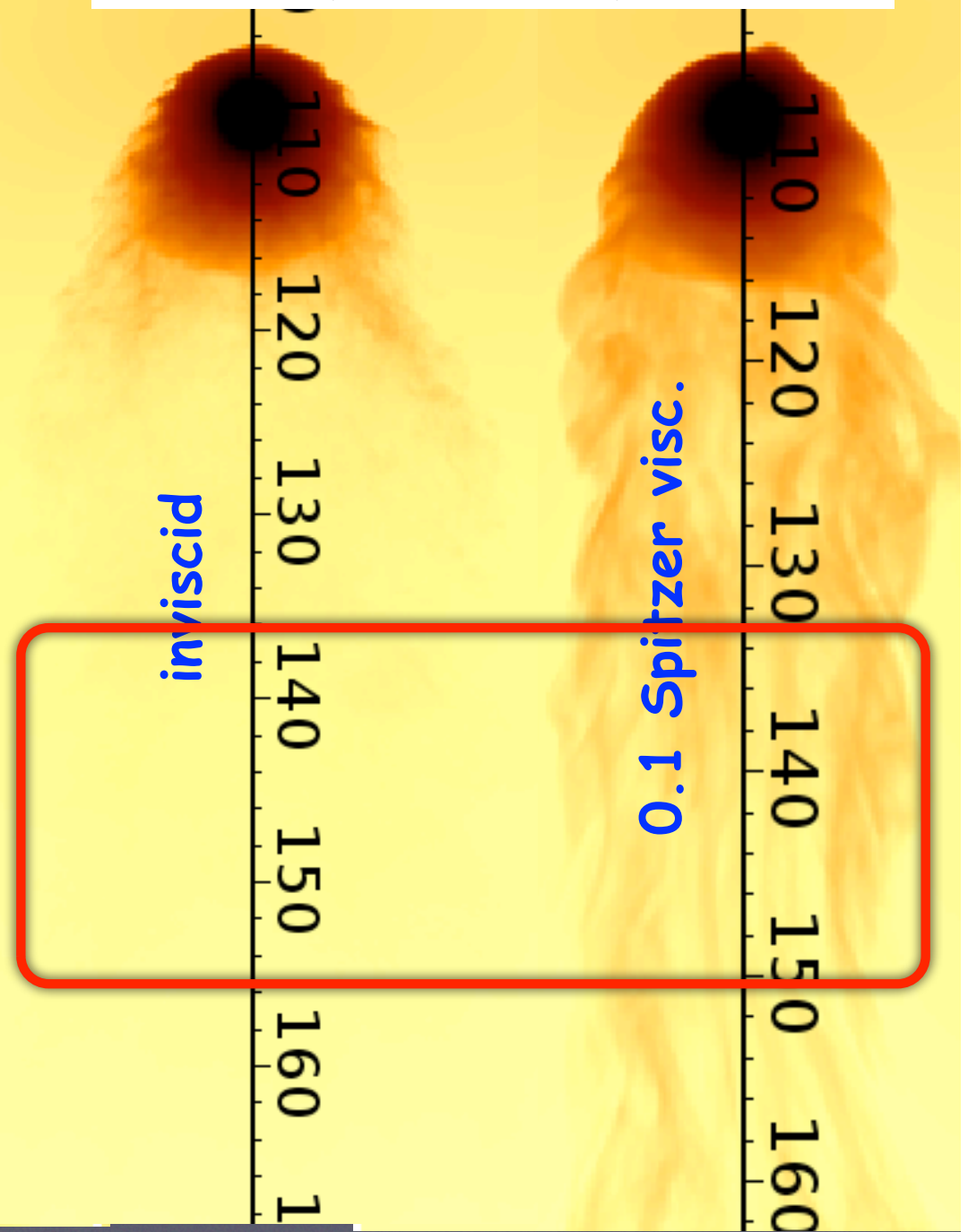
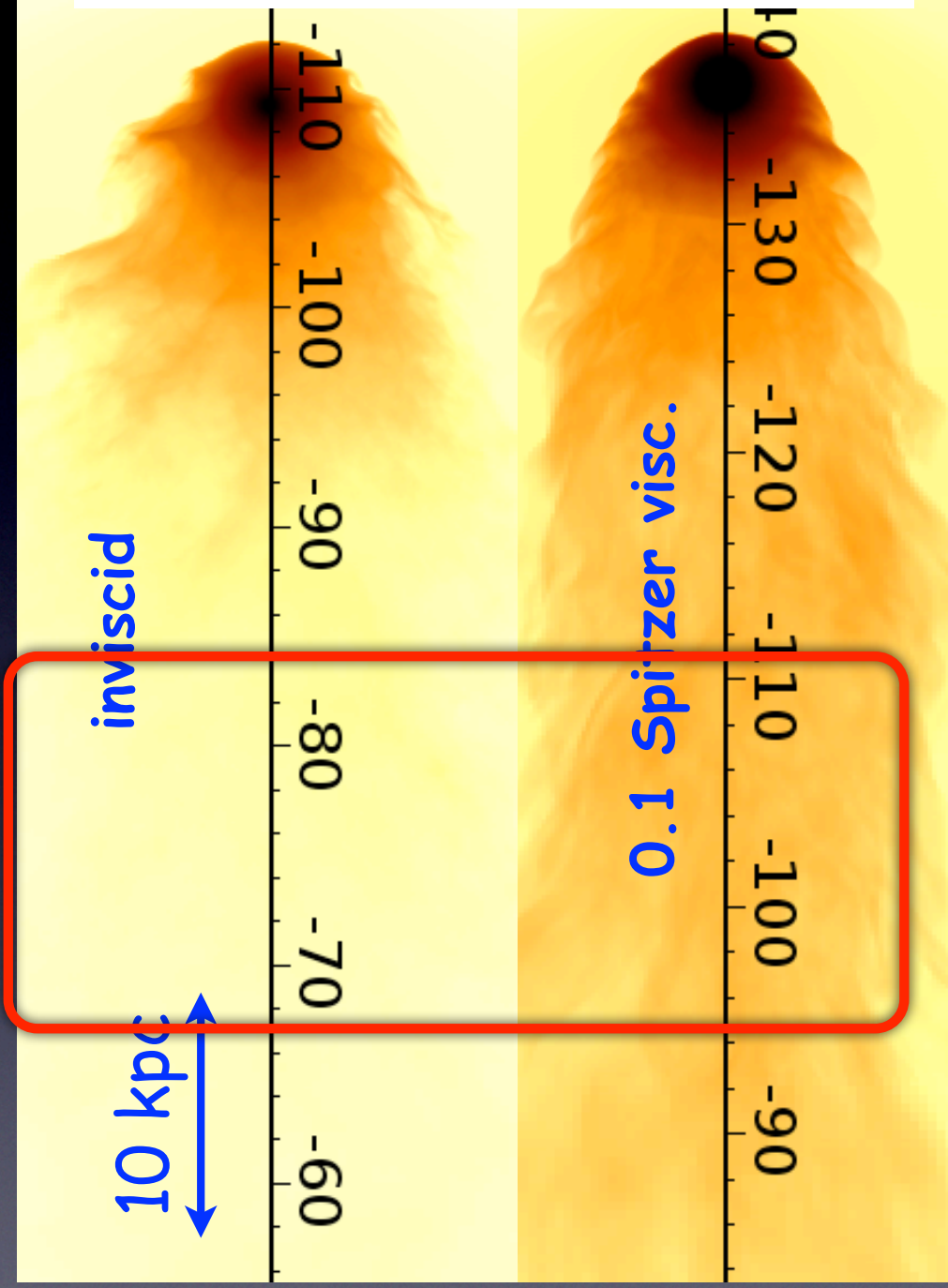
compact atmosphere



Mock X-ray (0.7-1.1keV)

extended atmosphere

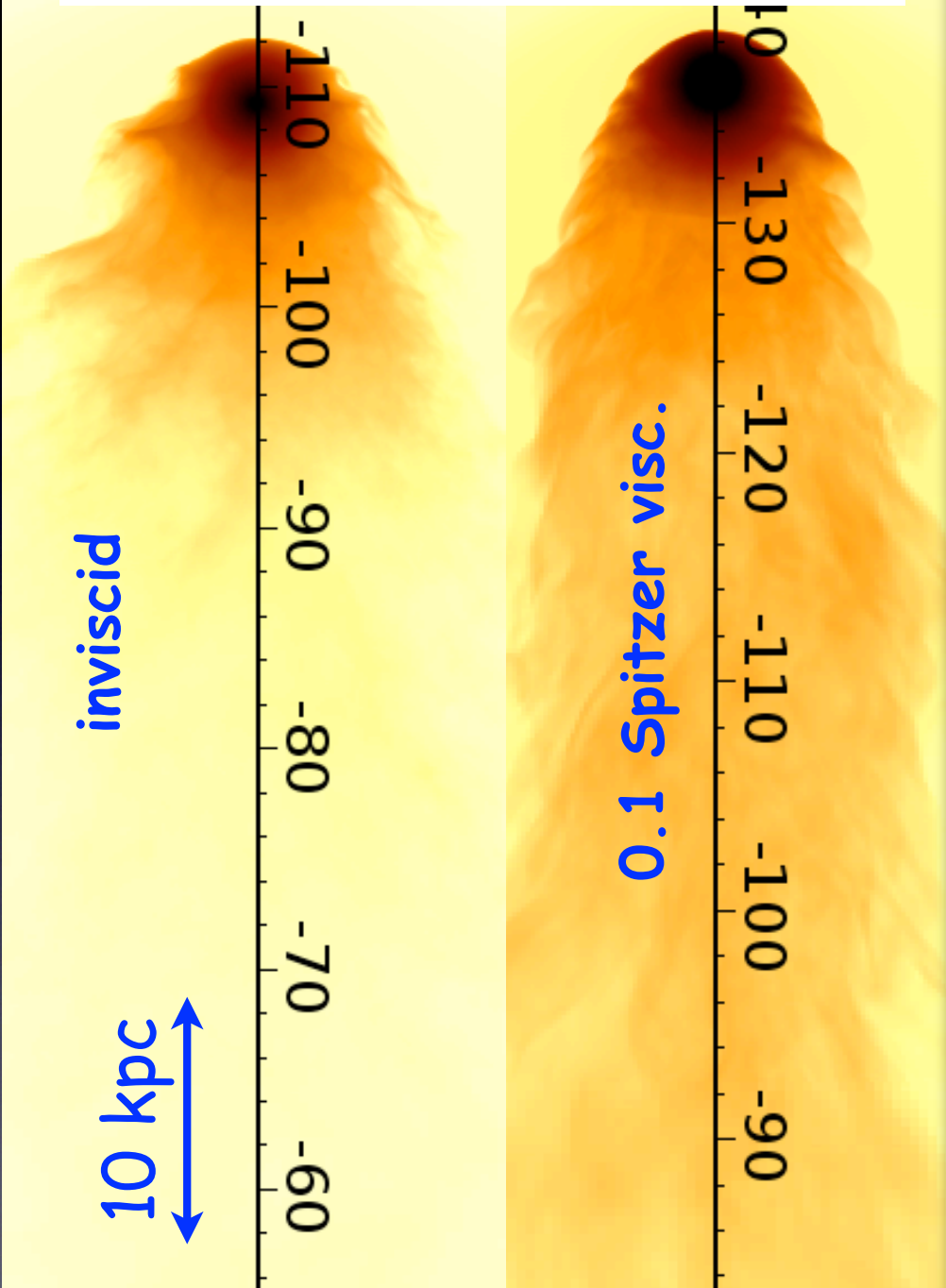
compact atmosphere



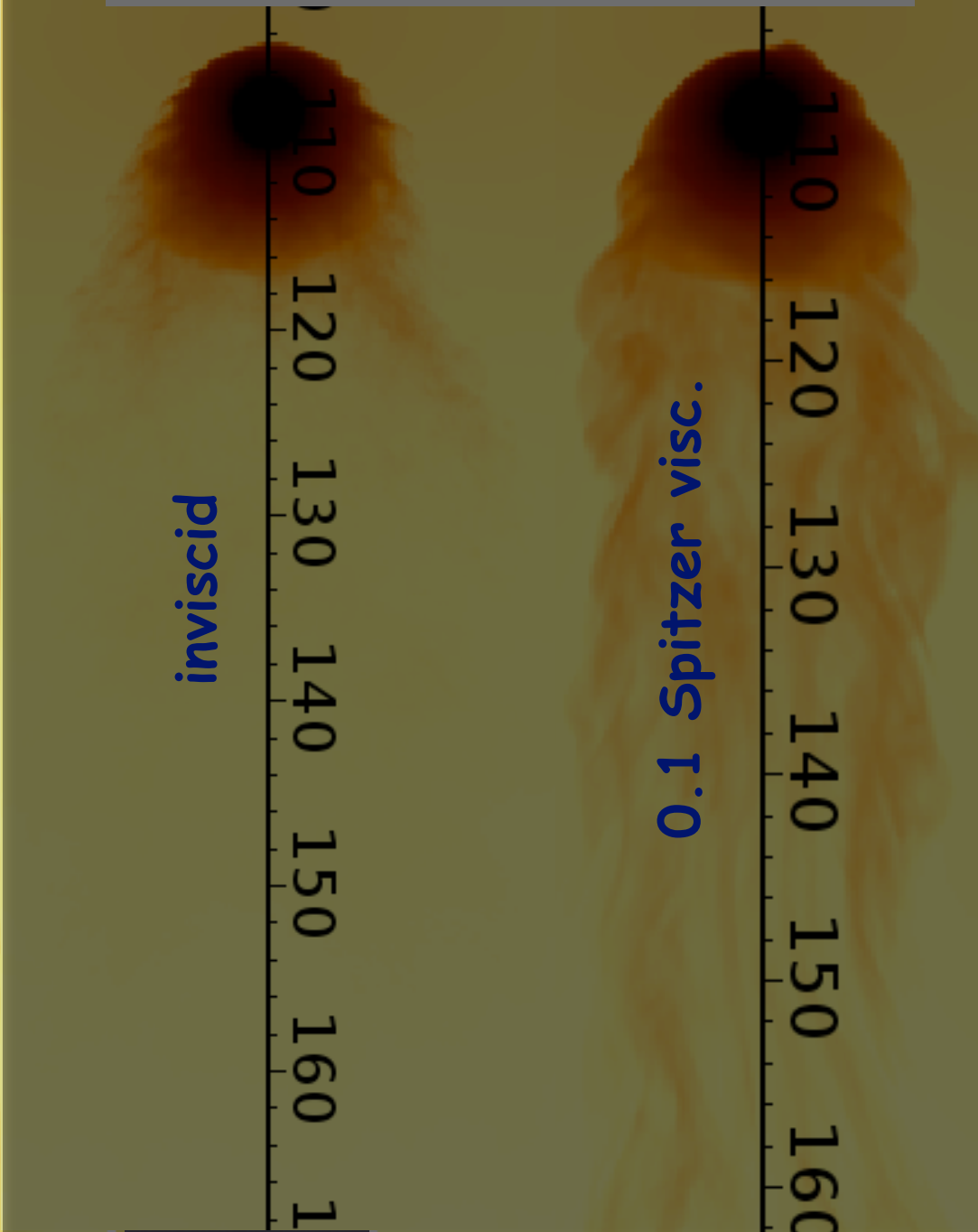
Mock X-ray (0.7-1.1keV)

extended atmosphere

101



compact atmosphere



Mock X-ray (0.7-1.1keV)

Elke Roediger

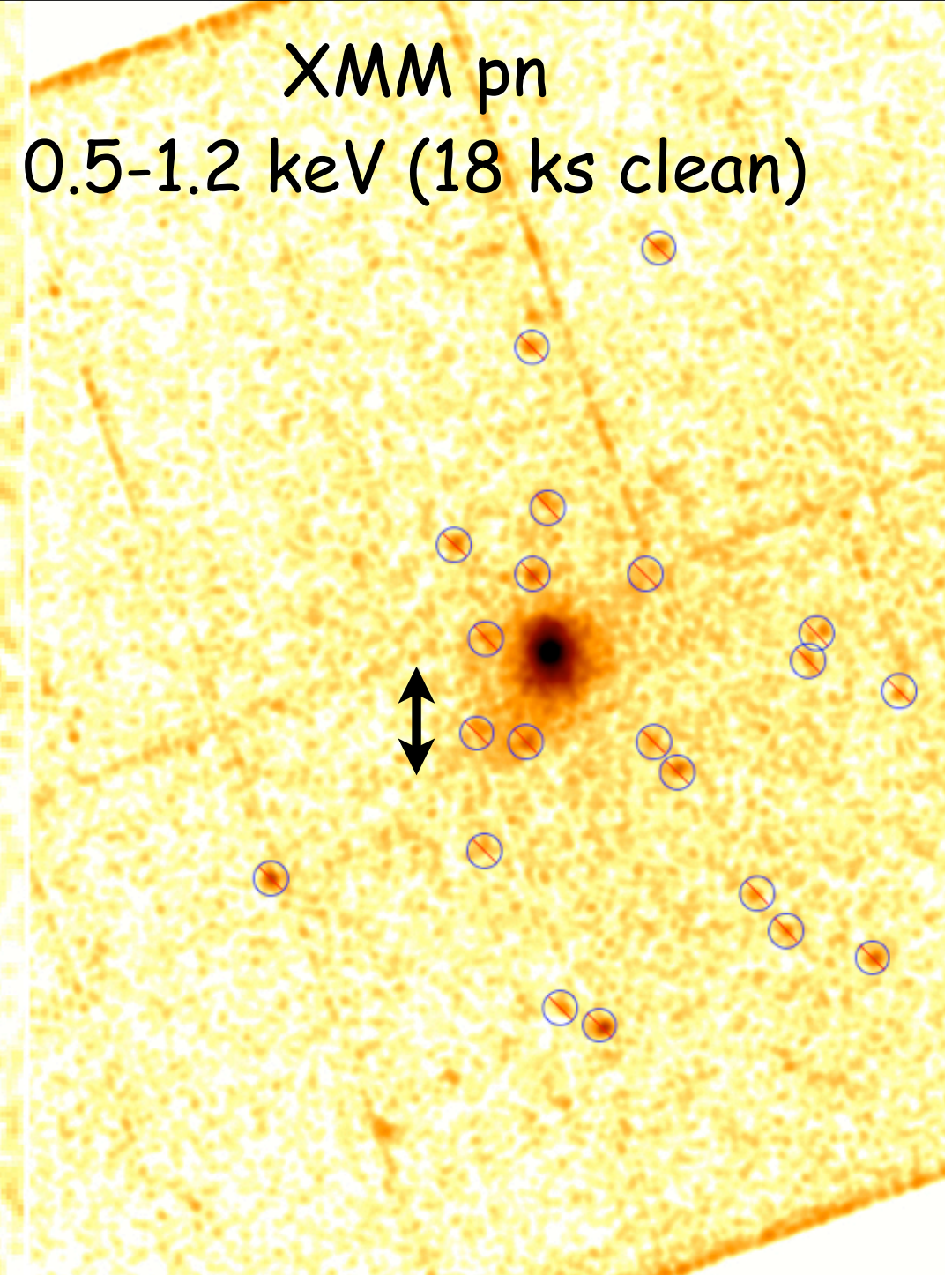
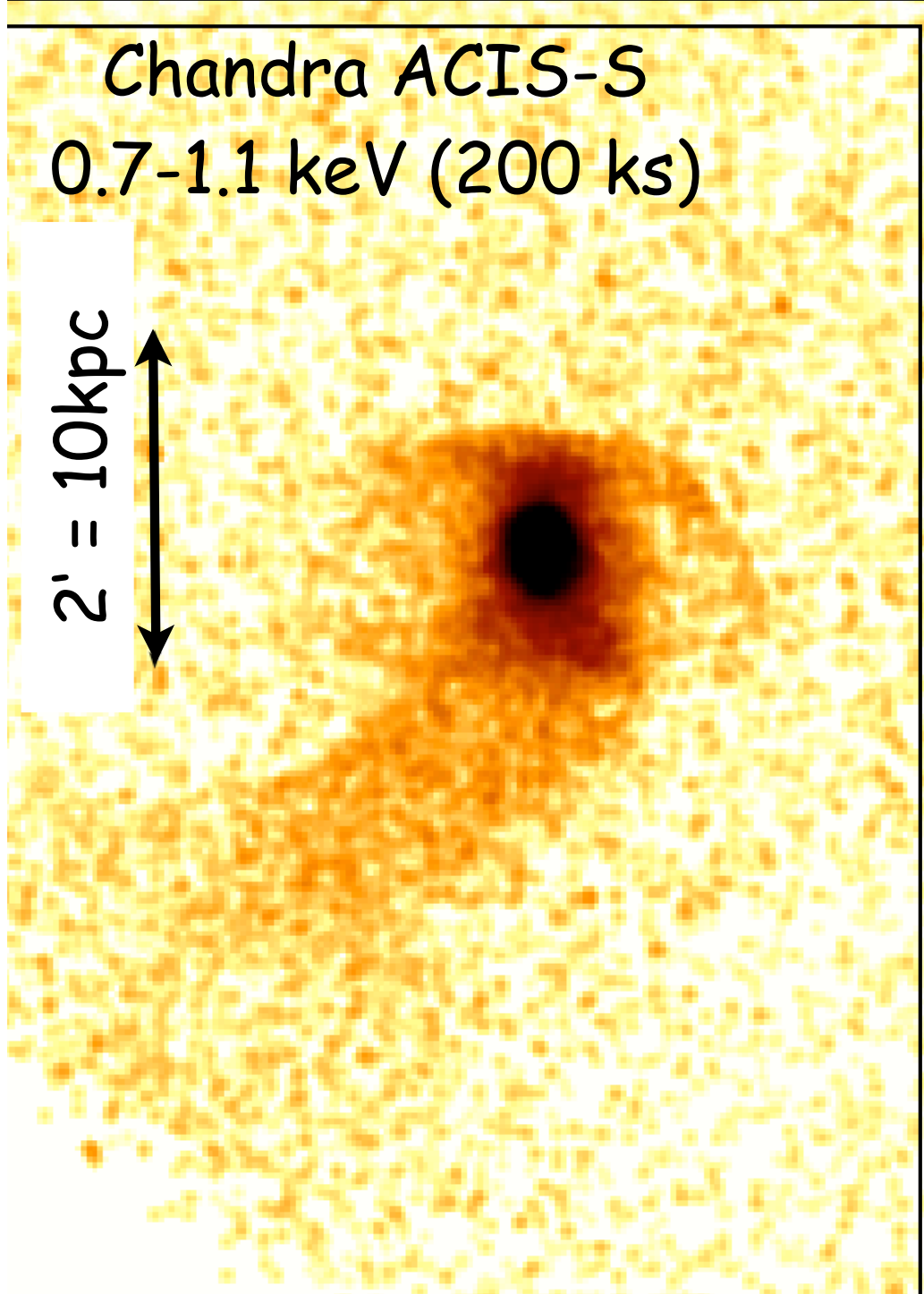


Chandra ACIS-S
0.7-1.1 keV (200 ks)

$2' = 10\text{kpc}$

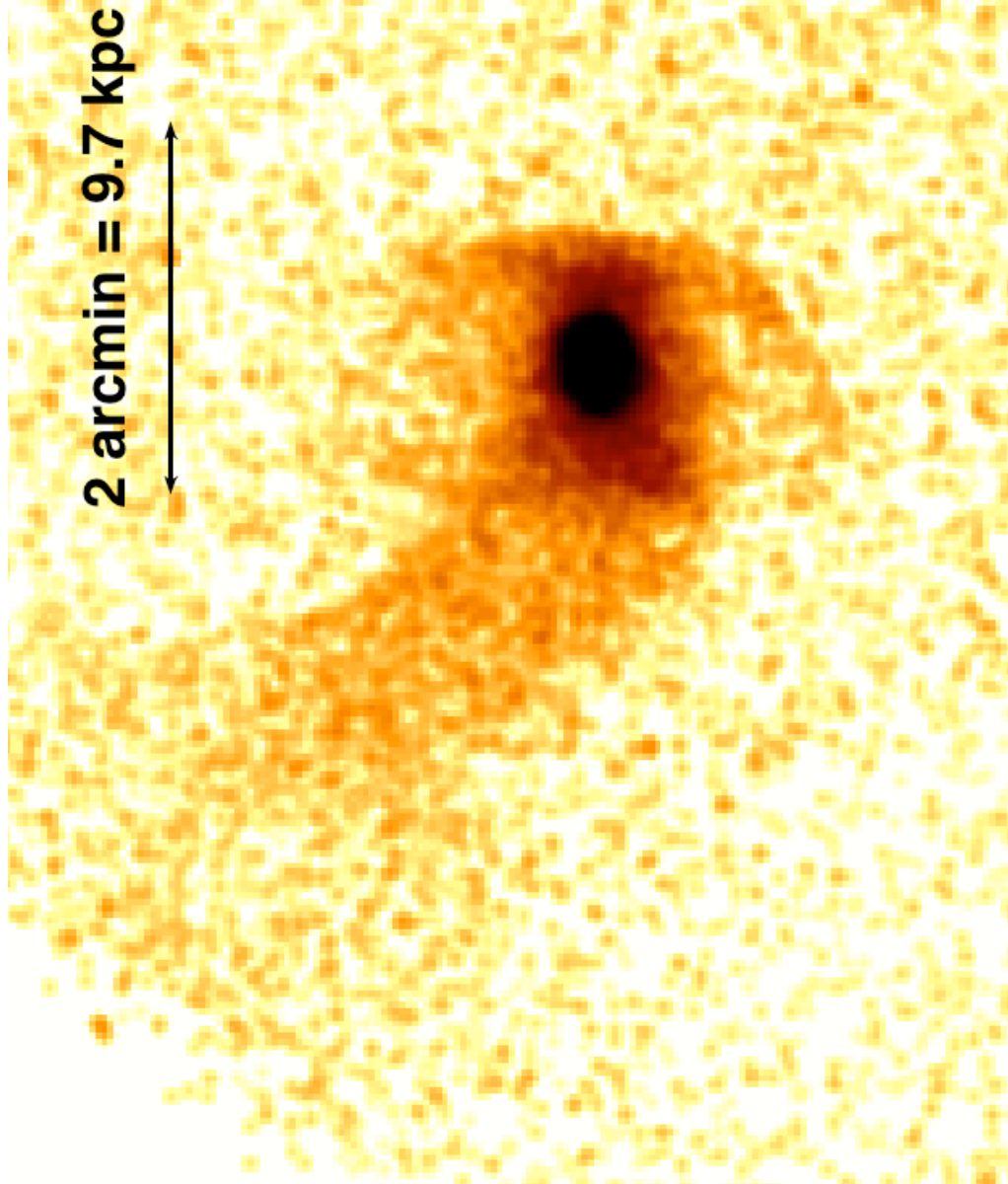


XMM pn
0.5-1.2 keV (18 ks clean)

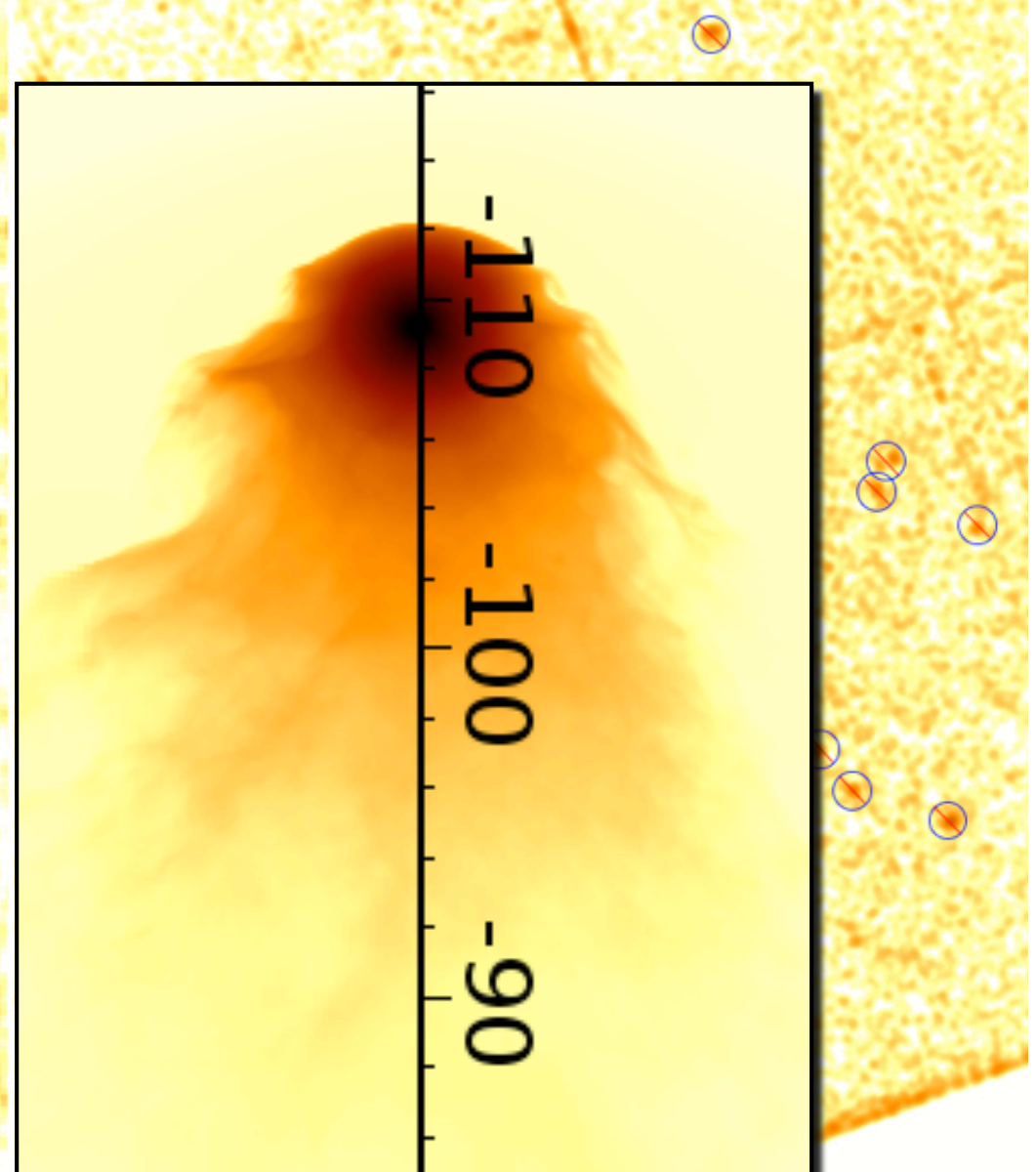


Chandra ACIS-S
0.7-1.1 keV (200 ks)

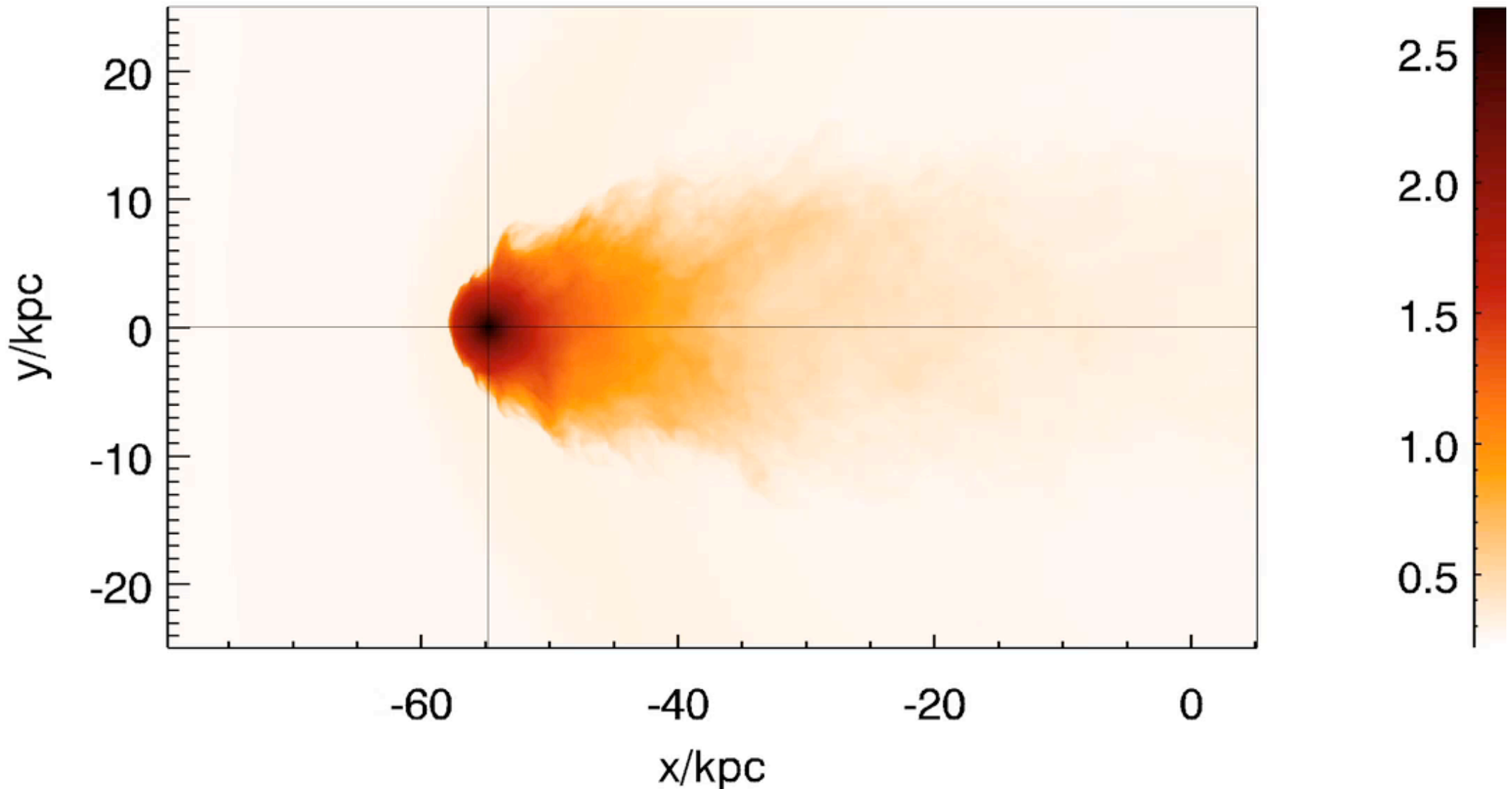
2 arcmin = 9.7 kpc



XMM pn
0.5-1.2 keV (18 ks clean)

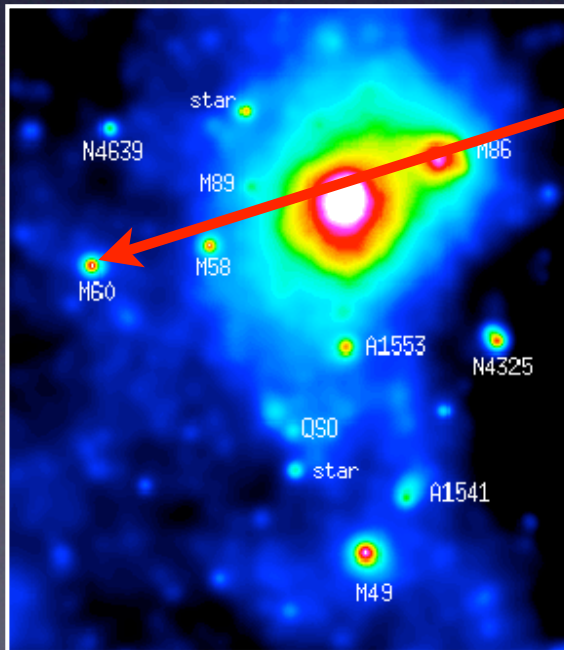
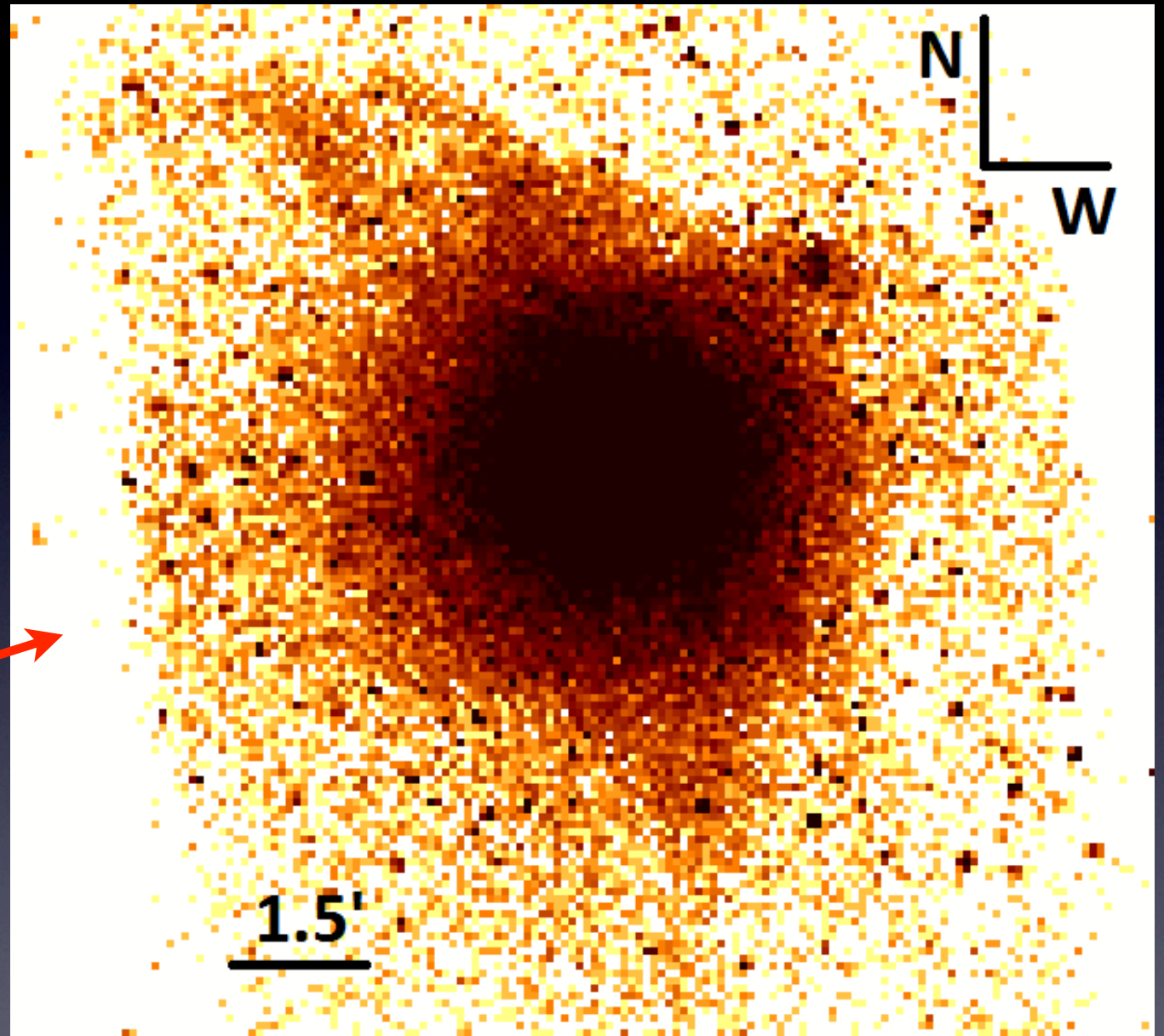


0.7-1.1keV band; $\log \text{LOS}/\text{kpc} = (-24, 24) + \text{obs. cluster BG}$ $i=0$ $t=40\text{Myr}$



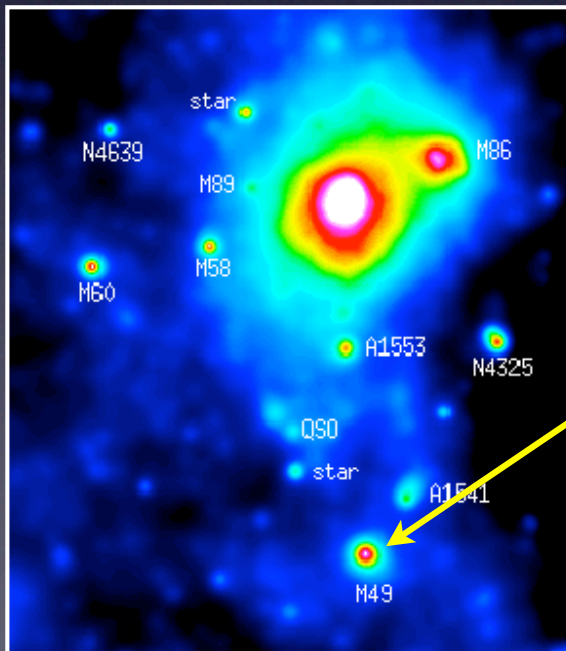
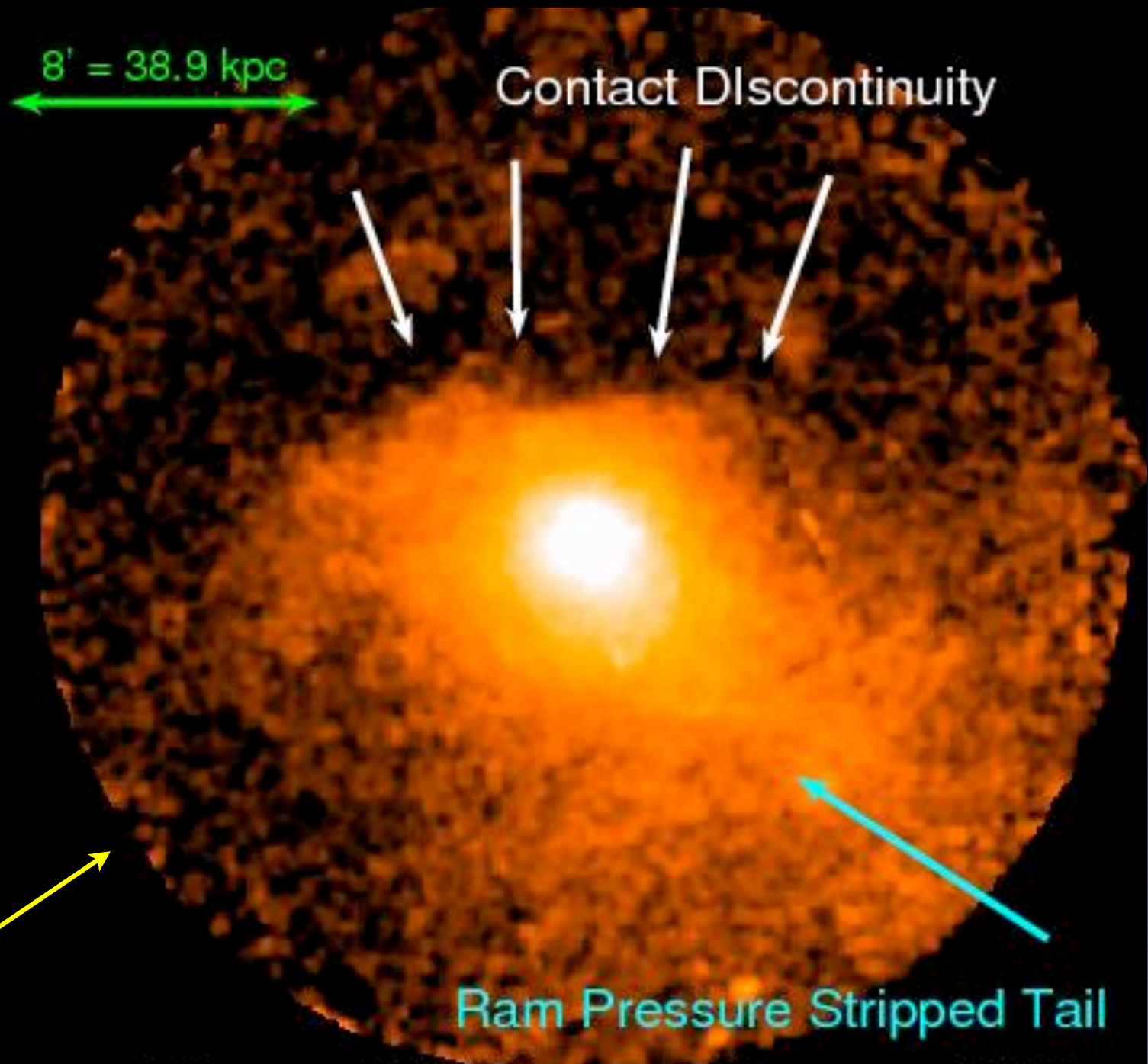
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NGC 4649 (M60)



Chandra mosaic (Wood+ 2014, submitted)

NGC 4472 (M49)



XMM-Newton image (0.5-2.0 keV) (Kraft+ 2011)

Chandra
mosaic,
0.5–1.5 keV

NGC 1399
(Fornax center)

upstream edge

NGC 1404

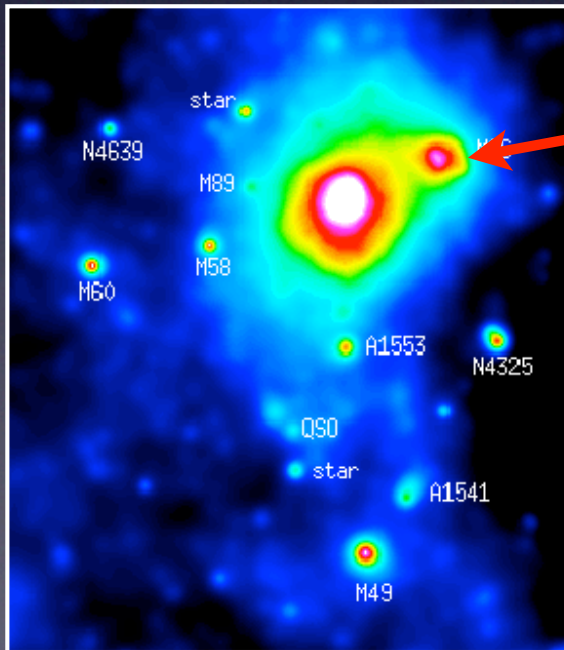
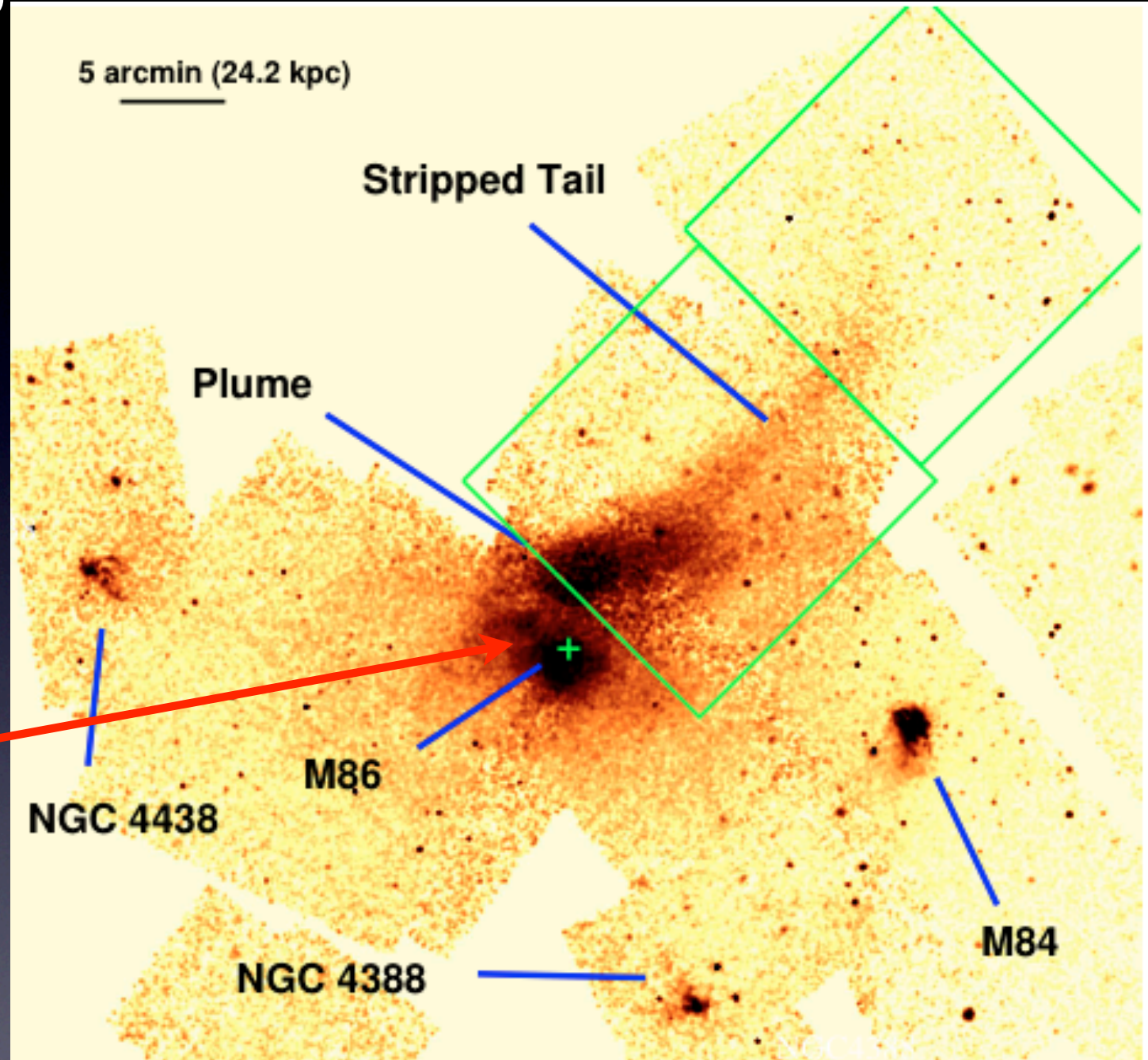
tail

1.32' = 7.7 kpc

9.8' = 57 kpc

NGC 1404
in Fornax
Machacek+ 2005

NGC 4406 (M86)



Chandra mosaic (Randall+ 2008)

N4438

SDSS, optical
CHANDRA,
Randall et al. 2008
H α ,
Kenney et al. 2008

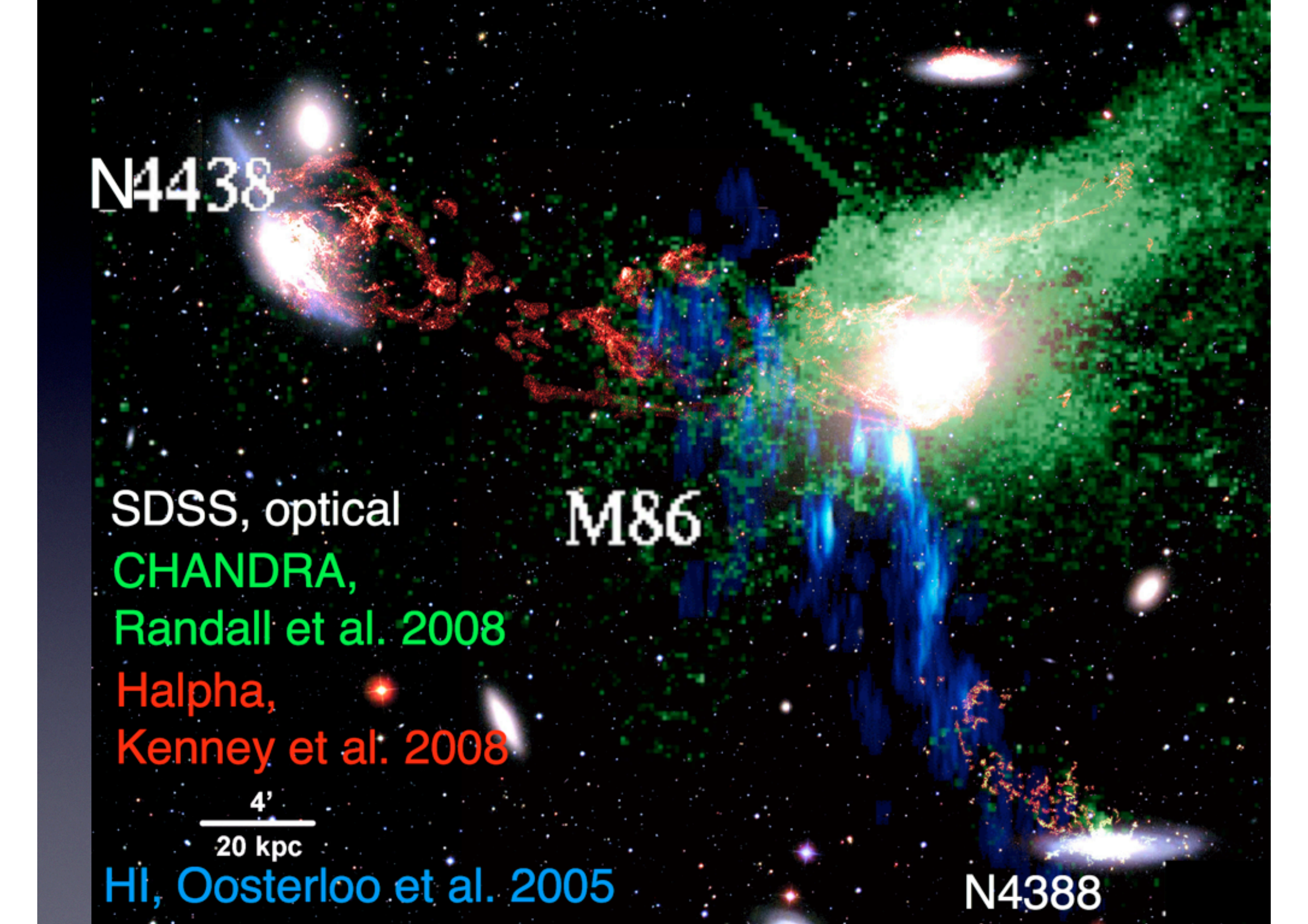
M86

4'

20 kpc

HI, Oosterloo et al. 2005

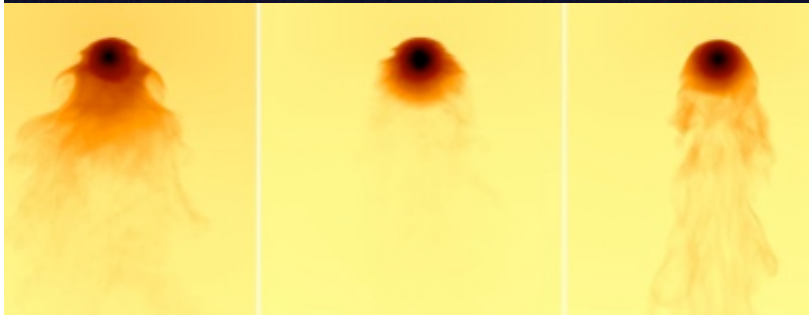
N4388



Summary

cluster dynamics
establish opportunity
for ICM mixing

ICM properties allow/
suppress/prevent it



observables for *correct dynamics*

first evidence against substantial isotropic viscosity

pilot studies done, more to come!

